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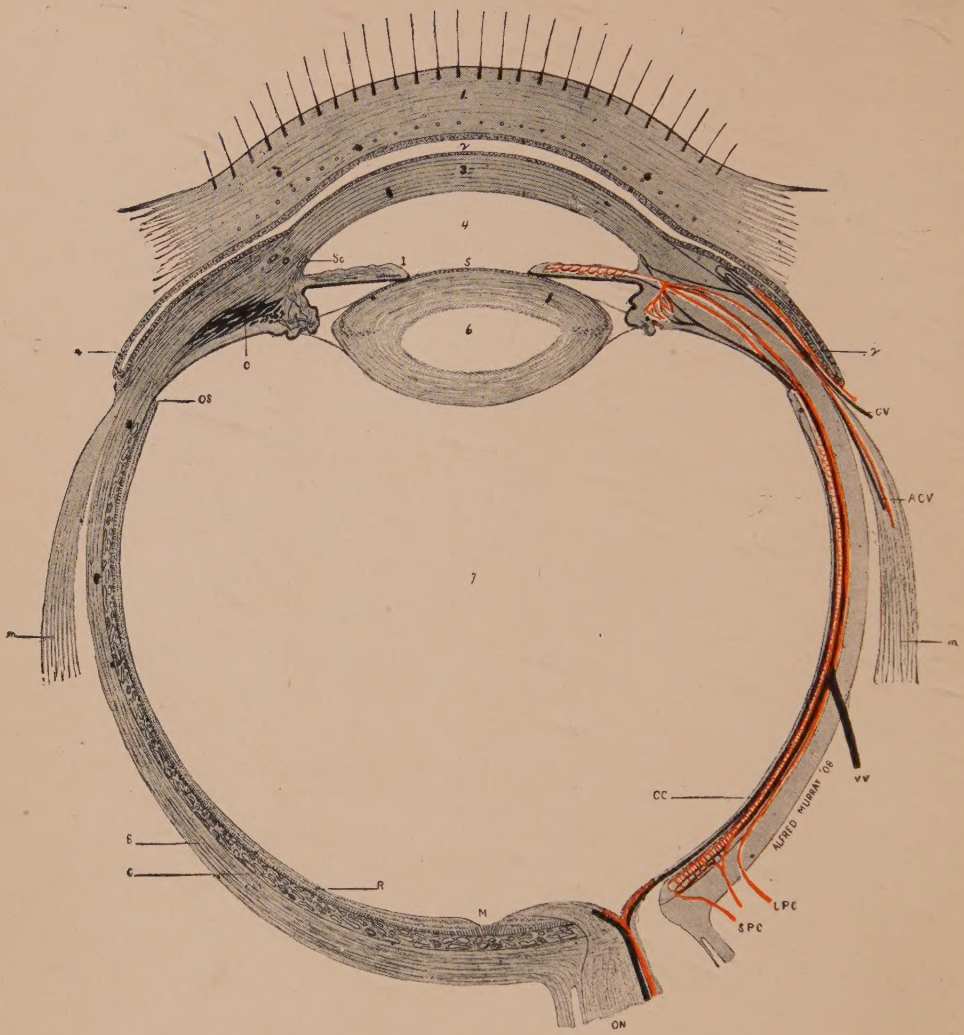

DIAGRAM---SHOWING HORIZONTAL SECTION OF THE EYE

1. Lid with cilia and Meibomian orifices.
2. Conjunctival sac.
3. Cornea.
4. Anterior chamber.
5. Pupil between two edges of iris.
6. Lens supported by Zonule of Zinn.
7. Vitreous.

LEFT SIDE

Sc. Schlemm's canal.
I. Iris.
C. Ciliary body with ciliary muscle.
OS. Ora serrata.
m. Rectus muscle.
S. Sclera.
C. Choroid.
R. Retina with macula lutea M.
ON. Optic Nerve.

RIGHT SIDE

CV. Conjunctival vessels.
ACV. Anterior ciliary vessels.
m. Rectus muscle.
VV. Vena vorticosa.
LPC. Long posterior ciliary artery.
SPC. Short posterior ciliary artery.
CC. Choroidal capillaries.

MINOR OPHTHALMIC AND AURAL TECHNIQUE

A Short Treatise Dealing with Minor Procedures About the Eye and Ear. Adapted to the Use of Those Requiring a Comprehensive Knowledge of this Subject.

BY

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1909

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TO

DR. CASEY A. WOOD

OF CHICAGO

WHO HAS CONTRIBUTED MUCH TOWARD THE ENRICHMENT OF OPHTHALMIC LITERATURE AND THE ADVANCEMENT OF THE SCIENCE, THIS BOOK IS RESPECTFULLY DEDICATED.

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PREFACE.

As is indicated by the title, this book deals only with minor procedures about the eye and ear, and is by no means a complete text-book on the subject of ophthalmology and otology. The subjects of major operations, pathology, ophthalmoscopy and refraction are, therefore, not entered into, since these are really special branches in themselves, and the mere superficial consideration which the limited space of this work would necessitate, would be of little value to anyone desiring a working knowledge of them. The book will, however, prove of service as a ready reference regarding minor points, particularly when one is engaged in the instruction of students or nurses who require detailed descriptions of all procedures, major or minor, particularly the latter.

In the experience of every general practitioner there are many times when he would like to familiarize himself with a few principles of ophthalmology or otology, such as simple methods of treatment, minor operations and minor procedures, after-treatment, and a thousand and one points necessitating reference to special text-books. Such books are not, as a rule, included in his library, nor has he the time to search through them for the points desired even though they are.

It is believed that medical students and nurses will find this work of value, since they are frequently called upon to assist in major operations, to perform minor operations themselves, and to carry out the details of after-treatment. They should, therefore, be reasonably familiar with the subject in order to render the best possible services. Minor details are often of nearly as much importance as the major operation itself.

It is, therefore, the object of this book to give some plain, simple principles of ophthalmic and aural technique, and in spite of its innumerable faults it is the hope of the author that

the book will be found sufficiently reliable to be of assistance to all who come in contact with eye and ear cases.

No claim is laid to originality in the text except in a few instances. The drawings are, however, original with the author, and although far from accurate they will at least serve their purpose of illustrating the text. The subject matter presented has been gleaned from innumerable sources, so many, in fact, that it would be impracticable to give individual credit for the material used.

To avoid possible confusion the reader's attention is invited to the double index of subjects, one for the eye section of the book, the other for that devoted to the ear.

The author wishes to acknowledge his indebtedness to Dr. Casey A. Wood, of Chicago, for suggesting the need of such a work as this, and for the marked interest which he has shown in its preparation. He also wishes to express his thanks to Dr. David Fiske, of Chicago, for his kindness in furnishing the original photographs which form an important part of the illustrations. He is likewise indebted to Dr. Frank Brawley, of Chicago, for his careful perusal and correction of the original manuscript and the many valuable suggestions he has offered.

Alfred N. Murray.

100 State street, Chicago.

THE EYE.

CHAPTER I.

GENERAL CONSIDERATIONS.

Office

Many of the major operations on the eye and practically all of the minor ones can be performed in the office, provided the equipment be sufficiently elaborate and the necessary asepsis can be secured. The ideal office of one doing eye and ear work should meet most of the following requirements: The length of the room should not be less than twenty feet, and there should be sufficient window space to admit plenty of daylight. The windows should be provided with dark roller shades, thus permitting regulation of the extrance of light and producing complete darkness when required. It is not necessary to have the walls painted black. A rug on a varnished floor is much preferable to a carpet.

At one end of the room are hung the test cards, exposing preferably but one at a time, and this is uniformly illuminated by protected side lights placed just far enough away from the card to avoid any shadows. The lights are controlled by a switch placed within easy reach at the other end of the room and immediately next to a similar switch controlling a point of light situated near the test card just below the level of the eyes. This latter is for the examination of the eye muscles. At the same end of the room, near the switches, stands a chair for the patient, and a small table holding the trial case. Nearby stands another table used for the purpose of holding the drop-bottle stand and the various instruments and paraphernalia used in treatment. A chair and a stool should be available for making ophthalmoscopic examinations. On one sidewall may be painted a small cross, and on each side of this, two or three feet away, a large round dot. The cross and dot are very serviceable when making ophthalmoscopic examinations, the patient being di-

rected to look at one or the other according to which fundus or which part of the fundus it is desired to inspect. Gas, with an Argand burner, is perhaps the best source of illumination, as the flame can be regulated to suit the will of the examiner. For retinoscopy, however, the electric light, sixteen-candle power, protected by a papier maché cylinder, and placed on a movable bracket, is perhaps more satisfactory. These sources of light are placed preferably near the treatment table.

As to the drug armamentarium, this, of course, differs according to individual taste, but such as that described in this chapter under the heading of "Ward or Dressing Basket," will be found to cover practically everything that one could need.

For an operating table the ordinary examining table or a level couch with leather cover will answer very well, although a regular surgical table always insures more thorough asepsis. An instrument cabinet with glass shelves, while not an absolute necessity, is of great advantage in protecting the delicate instruments used in eye operations. A four-candle-power electric light burning constantly inside of the case will prevent any deposition of rust on the instruments. This case also serves very well as an incubator in bacteriological work.

Home and Hospital

While the home has some advantages over a hospital in the matter of quietness, light regulations, temperature, ventilation, etc., there is no doubt but that the hospital is the ideal place for all serious eye conditions and operative procedures. The following points will, therefore, be considered as relating to the hospital, for that should be imitated as nearly as possible when substituting the home for it.

Room or Ward

The room or ward, as the case may be, does not necessarily have to differ from the ordinary except, perhaps, in the matter of light. Light regulation is often of great importance in the treatment of eye diseases and in the after-treatment of eye operations. There is no question as to the advantage of having eye patients in a room by themselves, or at least in a ward devoted exclusively to such cases. In the latter case, however, there are many disadvantages in view of the fact that one patient may be rightfully entitled to the enjoyment of the sun-

shine, although not able to leave the room, while another patient must of necessity be in darkness. A private room also conduces more to quietness, which is at times of great importance. This is particularly true following major operations, such as cataract extraction, where absolutely nothing should disturb the patient, and where he should not even engage in any conversation except the most necessary.

Furnishings

The furnishings of the room should be the simplest possible. The bed should be accessible from all sides. A fairly good-sized table upon which to place instruments or articles used in the dressing of cases is quite necessary. The less furniture in the room the better, as it makes that much less for the patient to stumble over in case he should walk around either by permission or in disobedience to instructions. A minimum amount of furniture is also more easily kept clean. The windows should be provided with roller shades by which light may be totally excluded when it is so desired, or graduated according to requirements.

Temperature and Ventilation

As to the temperature and ventilation of the room the ordinary rules apply. Great care should be observed that the patient be not exposed to cold draughts either while awake or asleep. This might result in a serious setback, prolongation of recovery, or even in ultimate loss of sight. The room should not be uncomfortably warm, as such a condition might cause the patient to become restless, with possible detriment to his condition.

In case the room has been occupied by a patient suffering from purulent disease of the eye, diphtheria of the conjunctiva, or any contagious or infectious disease, it should be thoroughly disinfected before being occupied by another patient. This is done in the ordinary way, either with formalin or sulphur. Particular attention should be paid to the linen, towels and sheets; in fact, all washable materials.

Illumination

As to the illumination of the room, no fixed rule can be laid down, as there is such a wide diversity of opinion on this

subject. Authorities differ—some say complete darkness, while others say it is wholly unnecessary, and that mere protection from direct light is quite sufficient in all cases. The subject will, however, be considered upon the basis of what seems to be the most reasonable regulation of light, and may be divided into two heads, namely, (a) following operations, and (b) in diseased conditions of the eye. Two subdivisions may be made of the first, namely, external operations, and intraocular operations.

Light Regulations

(a) Light regulations applying to external operations are simply those of ordinary surgical procedures—that is, to consult the wishes of the patient. So far as the eye itself is concerned, it is immaterial whether the room be light or dark, except in case of certain operations where use of the eyes is probihited, such as, for instance, in plastic operations about the lids. In these darkness will, of course, secure better observance of the restriction.

It might be set down as an invariable rule that following major operations (that is, the actual opening of the eyeball) darkness is a prime essential in the after-treatment. Where the iris or lens has been operated upon, the room should be totally dark, no light at all being admitted to the eye except that incident to necessary inspection. The room should be kept moderately dark for a day or two after the bandage has been removed from the sound eye. After this, the room can be made gradually lighter, dark glasses being worn and the patient's face being turned away from the light. As soon as the patient is able to be out of bed and moving around, light can be admitted into the room as much as is desired. It might also be laid down as a rule that under any circumstances the eye must gradually become accustomed to light after having been bandaged. It must again adapt itself to the influence of light even though it may have been bandaged for only a short time.

Darkness is quite advantageous in all cases where rest is indicated; the patient thus has no opportunity to use the eyes, and, therefore, all temptation is removed.

Since the pupil contracts to light, this should, of course, be excluded where contraction is to be avoided. Light should also

be excluded in all cases following blows upon the eye, and in severe injuries.

Where patients have been given permission to move about the room, it should certainly not be so dark as to prevent their seeing objects of furniture or sharp corners. They might stumble or come in contact with something with disastrous results.

At night, if illumination be required at all, it should be very dim; and appropriate shades should be adjusted to the source of light in such a way that it will not shine directly into the patient's face. This is, of course, observed in general conditions, but it is of all the more importance in affections of the eyes.

There should always be in the room a source of light which can be brought to within at least a foot or two of the patient's face in order to facilitate examinations. The ordinary gas-arm or chandelier will not do, owing to the fact that it is usually a great distance away or too high up.

(b) There are many diseases of the eye in which it is desirable to exclude light, and many in which this is necessary, although it is only rarely necessary that a patient be confined to a dark room.*

The object is only to modify the amount of light and not to exclude it altogether; to do the latter might even result in harm, perhaps prolonging the condition by rendering the eye more sensitive.

Protection from light is, of course, required in all conditions of the eye where photophobia is a prominent symptom, as in diseases of the cornea, such as ulcers and inflammations. Patients afflicted with eczematous keratitis are particularly sensitive to light. Eczematous conjunctivitis is also characterized by extreme photophobia.

Among intraocular conditions requiring protection from light may be mentioned acute inflammation of the lining coats

*There is a popular idea regarding measles and scarlet fever that the patient should be confined to a dark room on account of the eyes. This is not absolutely necessary, for dark glasses are usually quite sufficient unless the photophobia be extreme. The eyes in measles are affected very rarely in any part other than the conjunctiva.

of the eyeball, or of the optic nerve; also inflammations of the iris and of the ciliary body—particularly the latter. The condition of irritable choroid is quite frequent in weak, neurotic individuals, or those suffering from eye-strain; hysteria may also be assigned as a cause of photophobia, although it is probable that the weakened condition of the nervous system is responsible in this case.

Where the pupils are dilated, exclusion of light by darkness is indicated. Atropin, for instance, is seldom used without at the same time prescribing dark glasses; the peripheral parts of the interior of the eye are not accustomed to light and must, therefore, be protected.

Since the matter of light is under discussion it may be well

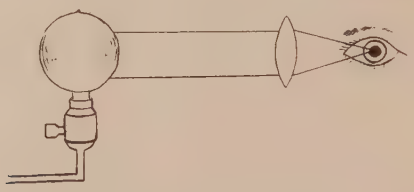

Fig. 1. Focal Illumination.

to introduce here the subject of focal illumination, as one will often be called upon to illuminate the field, not only in the operating room, but at the bedside as well. This is the illumination of the external parts of the eye by means of a strong magnifying glass—a so-called plus (+) lens. For this purpose there is generally used a lens which brings rays of light to a focus at a distance of about three inches. This is often necessary in inspection of the eye, or for the purpose of some minor procedure such as the removal of an eyelash, or of a foreign body from the cornea. The room should be dark, and the light should be placed about two feet to the side and a little in front and above the patient's eye, while he looks straight ahead. The lens, which is held by its margin with the thumb and forefinger at right angles to the rays of light, is moved back and forth between the light and the patient until the most brilliant point of illumination is obtained. Various conditions which would otherwise escape detection or recognition are determined by this illumination.

Position

As to the position of the patient in the room, whether he be in the recumbent or sitting posture, or whether he be allowed to walk around, authorities differ almost as much as they do regarding light, and, therefore, no set rules can be laid down on this subject. It might be said, however, that following all major operations on the bulbus, the patient should maintain the recumbent position for at least two or three days, although it is not absolutely contraindicated for him to sit up on the second day. This is also true in case of plastic operations on the lids, or following any operation where complete rest of the eye musculature is demanded. Bed predisposes to sleep, and, therefore, the recumbent position assures rest by virtue of this fact. The recumbent position is also indicated in various diseased conditions of the eyes, such as the following: Detachment of the retina; intraocular hemorrhage, whether spontaneous or the result of injury; in all serious injuries of the eye, particularly when associated with perforation of the bulbus; also in case of ulcers of the cornea where perforation may occur at any time, as in progressive ulcer *(ulcus serpens)*.

In severe inflammatory conditions of the eye, both external and internal, it is best to keep the patient in bed. In the matter of old people, however, the case is different; they should be hurried out of bed as soon as possible, owing to the danger of lung hypostasis, pneumonia, and extreme loss of strength from lack of customary exercise. Such patients may be raised to the semi-recumbent position on the second day. Such a procedure may also be necessary in young and robust patients who are not accustomed to being confined to bed, and whose restlessness is even more detrimental than the upright position.

The more reasonable the patient is, the more liberty he may be given. If the patient must absolutely maintain the recumbent position for several days, he should not be allowed to arise to attend to the excretions; if necessary, in extreme cases, the catheter and bed-pan should be resorted to rather than allow him to risk leaving the bed. Usually after the fourth day following major operations the patient may be allowed to sit up on a chair—a few hours at first, and then gradually lengthening the time until he may remain up all day. He should not

be permitted to walk around until the ninth or tenth day, and even then with great caution. Conditions of injury and disease are, obviously, governed by the course of the affection.

Psychoses

Various psychoses may develop in patients during the period of recovery following operations, or in some individuals suffering from diseased conditions of the eyes. This is particularly true in the case of alcoholics and old people. In the former delirium tremens is, of course, the usual manifestation, and it is often necessary to satisfy, at least to a certain extent, the excessive craving for liquor; or it may be necessary to keep the patient under the influence of chloral and bromides. In the case of old people, the patient often becomes restless, tries to loosen the bandage, becomes unmanageable, cries and complains about everything, develops hallucinations, and may even be threatened with delirium. These symptoms may develop on the day following the operation, but usually not until the expiration of a few days; and it may be even weeks before such symptoms make their appearance. The duration is very variable, although the prognosis is usually good. It is, of course, possible to have permanent impairment of mentality. The patients may even die under such conditions. Sudden death sometimes occurs in old people following major operations on the eye.

Body Temperature

As regards body temperature in eye diseases, there are very few morbid conditions of the eye which are accompanied by rise of temperature and increased pulse rate. Those of the suppurative type, such as panophthalmitis, or erysipelas, form an exception.

General conditions as a cause of increased temperature must not be overlooked. It is, however, quite important to record the findings of temperature and pulse (particularly in operative cases), as by this means any departure from the normal course of recovery may be detected.

Temperature may be slightly elevated as the result of worry, which is of particularly common occurrence in eye patients. This is probably in consequence of the dread of going blind. General symptoms, such as nausea and vomiting, also

sometimes accompany the rise in temperature; and this symptom, occurring post-operative, may be an indication of so grave a condition as glaucoma. This will be considered later.

Habits

A few words may be said as to the habits of the patient during his course of treatment. Any tendency toward alcoholism will either be manifest, or will assert itself before he has been under care very long. Excessive indulgence is, of course, as strictly contraindicated in affections of the eye as in all other diseases, and it is best to refuse his demands as much as is consistent with proper conduct on his part.

But, above all, reading occupies perhaps the first place as something which should be absolutely prohibited. Even though the one eye be good, use of it might injuriously affect the other. Of course, in cases of external operations, where the bulbus has been in no way attacked, and after both eyes have been freed from any sort of bandage, reading is not contraindicated. Vision with both eyes together must be one of the prerequisites, however, as any attempt to read with one eye alone is likely to prove injurious.

All bodily exertion is contraindicated in cases where the bulbus has been opened either through operation, injury or disease. By this is meant such acts as straining at stool, coughing, sneezing, or rising from the bed. Anything which the patient is obliged to reach for should be placed on a stand near the bed so that he will have the least difficulty in grasping it. Movement of the jaws, as in eating, chewing gum or tobacco, is also contraindicated, and for this reason fluid diet is advisable for a few days. Coughing may be prevented by slow, deep breathing through the nose; and sneezing, by pressure upon the upper lip. Meddling with the eye bandage should certainly be prevented, not only because of the possibility of introducing infectious material, but also because of the danger of exerting pressure on the wound. If the patient be inclined to restlessness, administer an opiate rather than allow him to place his eye in jeopardy.

Smoking may as well be entirely prohibited until the patient is quite well; although it might do no harm after every-

thing is on the high road to recovery, it is best not to take any chances.

It is needless to mention that the patient should not sit with his face toward the light, whatever the source of light may be. He should not look out of the window if the act in any way strains his eyes. It is particularly important that his excursions from the room or ward should be rather strictly limited, if he be allowed to go at all; or if it be deemed advisable to leave the room it should be under the supervision of a nurse or other attendant. After severe operations he should not be allowed to converse any more than his wants absolutely demand. It is best to make inquiry about the urine five or six hours after an operation, and to see that this is attended to. The bowels are sometimes locked for two or three days; if not, particular care should be taken to see that it is not necessary for the patient to strain.

External operations do not, of course, require the observance of such rigid precautions, and many more liberties may be allowed. In all operations, however, where movement of the bulbus is contraindicated, it is best to observe rather strict rules.

Ward or Dressing Basket

In hospitals various means are devised for carrying around the necessary paraphernalia used in dressing cases. In some hospitals an ordinary tray is used, while in others quite an elaborate outlay is gotten together in a basket. The latter is really the most practical, as it is more easily handled, and more can be accommodated in approximately the same space. But whatever the means of carrying them be, the following articles, dressings and solutions, must be at hand to supply the immediate requirements of the attending oculist in bedside examinations and treatments: A large pair of scissors for removing dressings; a stock bottle of boric acid solution for irrigation and to facilitate the removal of dressings, and a small bowl to put it in; an irrigating bottle; a roll of sterilized absorbent cotton for sponges and subsequent dressings; cotton applicators; a small surgical dressing case; a portable lamp for examinations—such as the Priestly-Smith lamp (described at the end of this sec-

tion); one or two condensing lenses; a "loupe," or magnifying lens, of at least +20 strength; an ophthalmoscope with lens; adhesive strips 1-inch wide, preferably on a spool; cotton pads prepared in the manner described later on; gauze; roller bandages of gauze and muslin 1½ and 2 inches wide, and 3 and 5

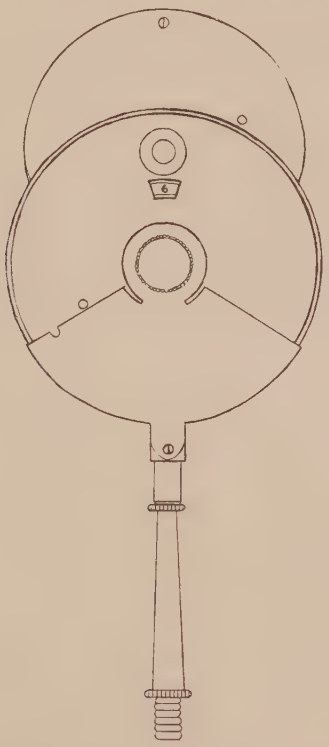

Fig. 2. Loring Ophthalmoscope.

yards in length; safety pins, protective pads for the eye; and, finally, a towel for the hands of the surgeon. Aside from these the following solutions should be on hand in drop bottles: Atropin, 1 per cent; eserin, 1 per cent; euphthalmin, 2 per cent; holocain and cocain, 1 and 4 per cent, respectively; boric lotion; adrenalin, 1-1000; fluorescin, 2 per cent; dionin, 5 and 10 per cent; silver nitrate, 2 per cent; argyrol, 20 per cent; protargol, 10 per cent; solutions in castor oil, of atropin, 1 per cent; eserin, 1 per cent, and cocain, 2 per cent; ointments of

atropin, 1 per cent; eserin, 1 per cent; cocain, 2 per cent; yellow oxide, 1 per cent, and a small glass spatula for their application; also collapsible tubes of White's ointment and brown ointment. (The collapsible tube affords perhaps the best means of applying salve to the eye.) This is quite a formidable array, but all the things mentioned are of importance, and the fact that they are immediately at hand may save many steps and many unpleasant words. It is well to familiarize one's self with the contents of such a basket in order to avoid difficulty in immediately finding what one wants.

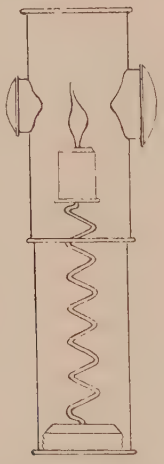

Fig. 3. Priestley-Smith Lamp.

The Priesty-Smith lamp, mentioned above, is a hollow metal cylinder, having a magnifying lens inserted in a short projecting cylinder near the top. The source of light is a candle which rests on a spring in the cylinder. The lamp becomes very hot after having been lit for a short time, and care must, therefore, be used in handling it.

Instructions

In the case of nurses, particular attention should be paid to recording the instructions of the attending physician, as all matters concerning the eye are of the utmost importance. The instillation of the wrong drop, or the failure to instil the drop specified, might result in great impairment of vision, if not in total loss of sight. The notation should be entered when it is

received, and no attempt made to hold it in the mind with the idea of putting it down at some future time. No mind is infallible, and anything is much more certainly remembered when it is written on the history sheet.

Gentleness

If gentleness be of importance in general medicine and surgery, it is of all the more importance in the branch of medicine under consideration. In this specialty the "tactus eruditus," or educated touch, should be developed to its highest degree. The eye and ear, on account of their delicacy, resent anything like rough handling. Undue pressure exerted on the eyeball following an intraocular operation, for instance, may result in springing of the wound, and subsequent loss of sight.

It is also necessary to have the coöperation of the patient in order to deal successfully with him, and coöperation is much more readily obtained if attention be paid to this small and seemingly unimportant detail of gentleness. This is particularly true in handling children, although even the greatest efforts at winning their confidence are often unsuccessful, and it is necessary to control them by administering a general anesthetic.

Procedures about the eye and ear are of such vast importance that attention must be paid to points which in general surgery would seem to be superfluous. Some apparently trivial act of neglect may result in the undoing of all that even the most skilful surgeon has accomplished.

CHAPTER II.

ANATOMY AND PHYSIOLOGY. VARIOUS SYMPTOMS. HYGIENE.

Anatomy

[In view of the desirability of showing various steps of treatment with individual diseases, it has been thought advisable to give a very brief outline of some of the commoner affections of the eye. A brief review of the anatomy and physiology (as well as general hygiene) has also been incorporated, more with the thought of assisting those who have become a little "rusty" upon the subjects, than for the man who has kept abreast of the progress of the day in all the essentials of ophthalmology.]

The eye is a rounded globe (the bulbus), about one inch through in all its diameters. It is composed of a capsule which contains the vitreous and aqueous fluids. The external layer of the capsule is made up of a dense, white, inelastic membrane called the sclera, which is in reality a prolongation of the dura mater of the brain; this constitutes about 5/6 of the circumference of the globe, the remaining 1/6 being made up of a disc-shaped, transparent, anterior continuation of the sclera called the cornea. This is about 1/16 of an inch in thickness. Just where the cornea and sclera join is a very minute circular canal, the canal of Schlemm, which plays an important part in the circulation of the interior of the eye. This canal is not visible to ordinary inspection. Through the cornea one sees the iris or diaphragmatic, colored membrane, the opening through the center of which constitutes the pupil; this regulates the quantity of light entering the interior of the eye. The iris is controlled by a sphincter and dilator muscle. The black in the pupil represents merely the dark chamber within (just as in a camera), and when this cavity is illuminated by reflected light it is no longer black, but red. One often sees the eyes of individuals appear fiery-red at night, and this is merely because

the interior of the eye has been illuminated. The iris is variously colored according to the amount of pigment. Blue eyes indicate lack of pigment, as is the case in babies, which are almost without exception possessed of blue eyes when born. If the color is to change, it will do so within the first few weeks of life. Albinos are totally lacking in pigment; there is, therefore, nothing to prevent the light from entering the eye in unnatural quantities unless they squint the lids together, as they usually do. Owing to this illumination of the interior of their eyes a reddish reflex is seen, just as in the eyes of a white rabbit. An individual may have one blue and one brown iris, depending upon the distribution of the pigment. The pupil normally dilates in the dark and contracts in the light. One pupil may be slightly larger than the other and still be normal.

The lens is held suspended immediately back of the iris, the pupillary margins of which are in contact with it. It is controlled by the ciliary muscle, which will be described later. The lens is not normally visible owing to its transparency, but can be seen as a milk-white body behind the iris when it is cataractous. It divides the globe into two compartments—an anterior part which contains a thin, transparent, watery fluid called the aqueous humor, and a posterior part which contains a semifluid, gelatinous substance called the vitreous. This latter substance is separated from the sclera by the retina, a transparent membrane containing the spread-out fibres of the optic nerve which enters the eye from behind, and by the choroid or uvea, an extremely vascular membrane which is a prolongation of the pia mater of the brain; both this latter structure and the sclera assist in forming the sheath of the optic nerve up to its point of exit from the skull. About 3/8 of an inch behind the bulbus the retinal artery and vein enter the optic nerve, pass on into the eye, and become distributed over the interior. A cross-section of the eye (see Frontispiece) shows all these structures very plainly; it also shows the ciliary body, which is composed of muscular tissue arranged in a circular form and situated in the interior of the eye next to the sclera in a position corresponding to an area just back of the margin of the cornea. The flatness or rotundity of the lens is dependent upon the ac-

tion of this muscle. When one reads, the lens becomes rounded out, and when one looks away off into the distance the lens assumes its original shape, which is inclined to be flat.

The posterior two-thirds of the bulbus is enclosed in the capsule of Tenon, which consists of two layers in apposition with one another and lubricated so as to permit of free movement of the eyeball.

The eye is held in place by the optic nerve, and by the eye muscles which are attached around the opening through which the optic nerve leaves the skull. There are six of these muscles, and each one is attached anteriorly to the sclera just about where the capsule of Tenon ends; they perforate this structure just before they become attached. Four of these muscles are straight, and, therefore, called recti, one being attached above and one below—the superior and inferior recti; and two attached respectively on the side toward the nose and on the side toward the temple—the internal and external recti. The two remaining muscles are the superior oblique, attached above, after first passing through a little loop on the inner wall of the orbit well forward; and the other, the inferior oblique, attached directly to the bulbus below and out.

All of the structures within the orbit are surrounded by a cushion of fat and blood vessels, which completely fills the remainder of the orbital cavity.

Surrounding the orbit are a number of cells, or sinuses, which communicate with the nasal cavities. Below is the antrum of Highmore; on the nasal side are the ethmoid cells, separated from the orbital cavity by an exceedingly thin, almost parchment-like plate of bone; and above and in is the frontal sinus. These structures are frequently concerned in diseases of the eye, as they are quite commonly the seat of inflammatory conditions both acute and chronic.

The contents of the orbit is separated from the outer world by a thin, delicate, highly sensitive, transparent membrane called the conjunctiva. This loosely covers the bulbus in front, and becomes very much thinner and firmly attached on the cornea. It is prolonged onto the inner surface of the eye-lids, and forms above, where it turns over from the bulbus to the lid, the upper fornix or cul-de-sac; below, where it is similarly ar-

ranged, it forms the lower cul-de-sac. Thus, when the lids are closed, there is formed a sort of sac—the conjunctival sac—which normally contains but one drop of fluid. The conjunctiva becomes continuous with the skin of the lids at their margins, in which location are the many orifices of the Meibomian glands; into these the epithelium is also continued. These glands are situated above and below in the tarsal "cartilage," or supporting frame-work of the lids, which is really not cartilage at all, but yellow elastic tissue. It is mostly developed in the upper lids. The lid margins have a sharp inner border which is closely apposed to the eye-ball, and a more rounded outer margin along which are arranged the cilia. The lids are

Fig. 4. Lachrymal Apparatus. Lachrymal Gland, Canaliculi and Sac. Meibomian Glands and Orifices.

closed by a circular flat muscle, the orbicularis palpebrarum, which is supplied by the same nerve as the mouth, therefore the movements of these two muscles are more or less associated. For instance, in trying to open the eyes, the mouth often opens involuntarily. The upper lid is raised by the levator palpebræ superioris, which is intimately connected with the fibres of the superior rectus; also by the muscle of Müller, consisting of some delicate little fibres situated in the upper lid. These latter muscles are supplied by the sympathetic nerve, as is also the dilator of the pupil; one, therefore, often sees widening of the lid-fissure simultaneously with dilatation of the pupil when using cocain in the eye. The outer and inner canthi of the lids are those angles where the lid margins come together at the respective ends of the lid-fissure—(the space between the margins of the lids).

At the inner canthi, both above and below, are two minute

points or openings, communicating with the lacrymal sacs, each by a minute canal which runs horizontally inward from the point to the sac. This lacrymal sac is a short oblong structure, situated near the inner canthus, and lined by mucous membrane continued from the conjunctiva through the little canals; this mucous membrane is also continued on into the nose through the naso-lacrymal duct, which leaves the sac at its lower end. In this way the tears are carried from the eye to the nose. If one press against the inner corner of the eye a crackling sensation is often experienced, which is nothing more than the forcing out of the tears into the naso-lacrymal canal.

In the upper, outer corner of the orbit is a moderately large gland, the lacrymal gland, which secretes the tears, and communicates with the conjunctival sac by numerous little canals.

Physiology

The old idea of likening the eye to a camera cannot be improved upon, since both consist of a dark chamber with a lens in front. The lens must bring the rays of light to a focus on the sensitive film, or retina; if it does not, a blurred and indistinct image is the result, and in order to obtain a clear and perfect image the lens must be moved to a proper position, or some other lens must be substituted for it. So in the human eye the rays of light must be brought to a focus on the retina; if they are not, it is either the fault of the lens or the cornea, or else the fault lies in the formation of the eye.

There are three varieties of eyes—the normal, or emmetropic eye, in which the rays of light are brought to a focus on the retina; the myopic, or near-sighted eye, in which the rays of light are brought to a focus in front of the retina—the eye being too long; and the hyperopic, or far-sighted eye, in which the rays are focused back of the retina—that is, the eye is shorter than normal. Children at birth are far-sighted; a near-sighted eye at birth is pathologic.

Astigmatism is nothing else than an unequal curvature of the cornea or lens, the rays of light being brought to a focus at different places. For instance, one set of rays is focused behind the retina, and one set in front of the retina, at the same time.

Accommodation means the variation in the refracting power of the lens when things are seen at a distance or close at hand. It is regulated by the ciliary muscle. When one has belladonna in his eyes this muscle is put at rest, and consequently one is unable to see distinctly close at hand. In individuals who have attained the fortieth year of life, the lens begins to lose its ability to contract and expand regardless of the action of this muscle. They, therefore, lose the power of accommodation and are obliged to have glasses to help them out. This is a physiologic condition and increases gradually year by year, until at sixty there is no accommodative power remaining and a very strong lens must be used for reading.

Various Symptoms

Unilateral affections are usually due to a local cause. The presence of purulent secretion in the eye calls for inspection of the tear sac. This consists in pressing at the inner corner of the eye to see if any secretion can be forced out of the little puncta on the lids.

Sudden blindness is produced by various conditions. Aside from perforation of the bulbus with escape of contents, or severance of the optic nerve through injury (pistol wounds, fracture, etc.), it may also be caused by such factors as embolism of the central artery, hemorrhage into the vitreous or anterior chamber, uremia, and hysteria.

Burning, itching, sand, and foreign body sensation, usually point to some form of inflammation of the conjunctiva. A foreign body is, however, almost always located with ease by an experienced eye, and the history of its introduction can ordinarily be obtained. Scratching sensation in the eye is also generally due to foreign body, although minute, pin-head-sized, transparent cysts on the margin of the lid, or a turned-in eye-lash may produce the same sensation, and should be looked for.

A feeling of fulness often follows the instillation of cocain, or is a pure neurosis; it might possibly be a symptom of increased intraocular tension, although this is, as a rule, a definite pain and not merely a sensation of fullness.

Dryness is due to a diminution in the secretion of tears, or to dry conjunctivitis (conjunctivitis sicca).

The sensation of drawing is a muscular symptom, and is

usually due to errors of refraction and muscular anomalies. The sliding over of lines and objects and the mixing up of letters is also a muscular symptom.

Spots before the eyes (muscæ volitantes), which are best seen by looking at a white surface or a bright sky, are due to fine floating opacities in the vitreous, supposedly remains of embryonic cells; although large ones may be due to pathologic changes in the vitreous or inner coats of the eye.

The seeing of colors is called erythropsia, and often occurs following cataract operations; color blindness may also supervene under these circumstances. Hallucinations often develop in old people following cataract operations and assume all possible forms. Flashes of light are probably of vascular origin, and are of no particular significance. A circle of light may be produced by pressing on the eye through the closed lids, although it sometimes appears without pressure; it is seen upon the side opposite to that upon which pressure is made. Eyes blind to everything else may still be able to perceive this phenomenon. The significance is not altogether clear.

Pain. Pain in and about the eye may be due to a variety of causes. Probably the most frequent cause is trigeminal neuralgia; other branches of the trigeminus are also usually affected. Pain is usually present for about six hours following major operations on the bulbus, but should not continue much longer than this; when it does, it is usually an indication of mischief. Sharp, sudden pain in a freshly operated eye usually indicates springing of the wound or expulsive hemorrhage. Severe inflammation of the conjunctiva, such as purulent ophthalmia, may produce pain; but affections of the cornea are more prone to cause it than those of any of the superficial structures. Of these there may be mentioned phlyctenular (eczematous) keratitis, ulcers, serpiginous and herpetic in particular (the latter being also accompanied by temporal pain), and foreign bodies embedded in the cornea, which also give rise to quite intense pain. The pain of iritis and iridocyclitis, both of which conditions almost always accompany one another, is quite characteristic. It sets in with a feeling of discomfort and aching around the eye, which is soon replaced by actual pain, not only in the eye itself, but radiating over the brow and sometimes down on

to the cheek. This is especially severe at night. After a time it becomes constant. The pain in the rheumatic form of iritis is usually severe, although it may be absent. The pain in acute inflammatory glaucoma has also some characteristic features. It is transient and slight at first, but soon becomes severe and more constant, and is not only in the eye itself, but in the surrounding region as well. It is apt to be mistaken for supraorbital neuralgia, which would be a fatal error to make. As the disease advances the pain becomes almost unbearable and must be controlled by an opiate. Various conditions within the eye itself, such as suppuration (panophthalmitis), and foreign bodies embedded in the ciliary region, are accompanied by pain. Pain is also experienced, and sometimes in marked degree, following contusions of the eye-ball and other severe injuries.

In scleritis the pain may be very severe, or may be absent altogether. In retrobulbar inflammations there is considerable pain attending the muscular excursions, although this may also be the case in autointoxication, or when one is very much exhausted. Inflammation of Tenon's capsule will also give rise to severe pain upon attempting to use the muscles of the eyes. Styes on the lids, or abscesses developing on the lids or in the neighboring structures also produce pain, but are easily recognized. Refractive errors are often responsible for pain in and about the eye, being usually of the astigmatic nature.

Danger Signals. Various symptoms and conditions of the eye are of such great importance, in that they demand immediate attention, that they may be called danger signals. Some of them are quite characteristic, while others are of a more general nature; and some have been mentioned under other headings. It will do no harm to repeat them here, however, for an important fact cannot be too often repeated when sight itself may depend upon the recognition of a condition, and upon its prompt treatment.

Sudden pain following major operations usually indicates reopening of the wound, and calls for immediate inspection by the attending surgeon. Distortion of the iris is also a sign of reopening, or of its being clamped in the wound. Continued dull pain following cataract extraction, with excessive dis-

charge during the first twenty-four hours, usually indicates mischief; occurring during the first two or three days following the operation indicates infection of the corneal incision, in which case the edges of the wound present a grayish-yellow appearance, and a little deposit of pus may be seen in the anterior chamber.

Sudden, sticking pain may be a sign of the perforation of the floor of a corneal ulcer. Bulging of the floor must be prevented by the application of a pressure bandage. Recurrence of pain in corneal ulcers, accompanied by fresh injection, indicates further progress. Pain due to recurrent abrasion of the cornea occurs usually at night as a sharp, sticking pain, and is not likely to occur when the eye is bandaged. Prolonged irritation of the eye following removal of a foreign body from the cornea, with pain, lacrymation, and infiltration of the corneal wound where the foreign body was located, indicates infection.

Emphysema of the lids often results from too vigorous expiratory acts, such as sneezing or blowing the nose, and indicates the establishment of a communication between the nose and the circumorbital tissues through the ethmoid cells. The patient should avoid blowing the nose in the presence of such a condition, and with the aid of a pressure bandage it will soon disappear.

Subcutaneous hemorrhage making its appearance a day or two following a blow upon the eye or the orbital region, usually indicates a fractured skull; the discoloration may slowly extend to the opposite side. Following enucleation of the bulbus, reactive hemorrhage sometimes sets in; this is indicated by undue saturation of the dressings with blood, and should receive attention in order that the patient may not suffer from exsanguination. Expulsive hemorrhage may follow operations in which the bulbus has been opened, and is indicated by sudden pain and saturation of the dressings with blood; the eye is usually lost following such a mishap. Fresh blood in the anterior chamber usually follows operations and contusions of the bulbus, but is, as a rule, rapidly absorbed. A bright-green color of the iris indicates intraocular hemorrhage; a brown color, best seen in patients with blue irises, is called "siderosis," and in-

dicates the presence of a piece of iron or steel within the eye which is undergoing oxidation; the eye is usually lost.

Tension. The tension of the eye is said to be plus (+) or minus (—) according to whether a sensation of hardness or softness is imparted to the fingers upon palpation. This palpation is made by placing the index fingers upon the eyeball while the patient looks down. The remaining fingers should be rested against the cheek or forehead, being placed there before the index fingers touch the globe. But slight pressure is required, being made downward, and the procedure is similar to that for the detection of fluctuation in any other part of the body.

Fig. 5. Taking Tension of the Eye.

Reduced tension of the eye indicates perforation, or degenerative changes in the interior of the eye. Increased tension is a symptom of danger. When accompanied by ocular pain, nausea, and vomiting, general depression, and hazy cornea, it indicates the condition called glaucoma, which calls for immediate attention if the eye is to be saved. Increased tension is sometimes indicated objectively by sudden vascularization of the corneal wound, or bulging forward of a weakened spot in the globe. A small circumscribed bulging in the cornea, however, is not always accompanied by increased tension; this is called a descemetocele, and may exist for months without perforation or symptoms.

Deposits on Descemet's membrane, that is, little fine, white dots on the posterior surface of the cornea, which sometimes as-

sume a triangular shape, apex up, indicate an insidious or active inflammation of the ciliary body. They are also present in the condition known as sympathetic ophthalmia, one of the most fatal diseases of the eye. In the presence of pain and irritation of an eye previously injured by a foreign body, traumatic or operative, a tired and watery condition of the other eye, with blurred vision for near, are usually among the first indications of the beginning of sympathetic ophthalmia, and these symptoms should always be looked for if three weeks have elapsed since the injury to the other eye.

The presence of pus in the anterior chamber (hypopyon), indicates infection of an operative wound, corneal ulceration, or deep-seated inflammation, and under any circumstances is a danger signal.

The vitreous, when it protrudes from a wound, has the appearance of a shiny bead, and the presence of such a condition calls for immediate attention.

Hygiene

Hygiene of the eye consists not only in the proper care of the organ as an anatomical entity, as, for instance, avoidance of exposure to the exciting causes of eye affections, such as eye-strain, injury, infection, irritation, etc., but also in the recognition of ocular defects and the interpretation of the various symptoms.

As an initial statement it might be said that the eye is without doubt the most delicate and yet the most accommodating organ of the body. In spite of its delicacy, however, there is probably no organ in the body which is subjected to more abuse and strain than the eye. Services are demanded of it which one would be ashamed to demand of other grosser structures, and chiefly because of inability to interpret symptoms which indicate eye-strain and other affections.

If the muscles of the general body become tired upon prolonged use, it stands to reason that the delicate eye musculature must likewise reach a limit of endurance. This abuse of the eye is, however, frequently due to lack of information as to just what the organ is capable of standing.

General health has much influence over the eyes. Weak or improperly nourished muscles cannot be expected to perform

their functions well. Probably the best means of emphasizing the various points relating to the care of the eyes is by a series of "don'ts," which may be given as follows:

Don't have the light come from in front. If impossible to regulate this matter, adjust a suitable shade to the source of light, and wear an eye shade. It is best to have it come from behind over the left shoulder, and it should, if possible, be nearly on a level with the head. This is because of the fact that the right hand is ordinarily used for turning the pages, and, therefore, no shadow is thrown across the page when the light comes from the opposite side.

Don't read or do near work in a poorly lighted room; or with crossed lights; that is, lights coming from opposite sources. Aside from this, in any light the type should be large and correctly spaced, and the book or paper printed with good ink.

Don't hold the book closer than thirteen inches from the eyes, nor farther than twenty inches.

Don't read by firelight.

Don't use the eyes after they show symptoms of discomfort or become tired and inflamed, or when tired and sleepy.

Don't work at night on fine sewing, embroidery, china-painting, drawing, engraving, on black goods; and not at all on such things if the eyes are not perfectly sound, and even then the work should be interrupted with sufficient frequency as not to allow symptoms to develop on the part of the eyes.

Don't stoop over when reading or doing near work. This point is of particular importance as it relates to children.

Don't read lying down, especially when recovering from an acute illness; or don't use the eyes in any abnormal position. The upright position is always the best.

Don't read in the street cars, because of the constant jolting. The illumination is also usually poor.

Don't wear dotted or figured veils. These are responsible for much eye-strain. They should be thin, and with a large, uniform mesh, if worn at all.

The failure to observe these points is no doubt responsible, to a great degree at least, for the evident increase in eye affections.

Diffuse sunlight is the best means of illumination; but it should never shine directly or by reflection into the eyes; and the next best is the old-fashioned Argand burner, or student's lamp, with gas or kerosene. Electricity, however, affords a much steadier illumination, and the atmosphere is not vitiated by the gas combustion, nor is so much heat generated. The frosted globe is preferable.

CHAPTER III.

INFLAMMATIONS AND COMMONER DISEASES.

Lachrymal Sac

This structure is quite commonly the seat of inflammatory and pathologic changes, and occupies an important position in the field of eye diseases. Inflammation of this sac is known as dacryocystitis. It may be acute or chronic; and may be catarrhal or suppurative. The source of the condition is usually the nose. If the sac be enlarged so that it stands out quite distinctly, it indicates a closure of the communicating canals, the contents being either mucus or pus; the latter condition is indicated, as a rule, by pain, redness, and swelling, which may involve the surrounding tissues. The swelling may be of variable degree, and is situated just below the inner canthus next to the nose. The pus may find its way out through the skin, and thus give rise to a fistula. The contents can generally be squeezed out through the lachrymal puncta by exerting slight pressure over the sac.

Treatment of the suppurative type consists in the application of hot compresses and careful syringing with the lachrymal syringe; or, if necessary, simple incision through the skin. In the chronic form, the canaliculi are slit, the sac is irrigated, and probes of various sizes are passed. The sac is often removed in its entirety.

Injuries and Burns

Wounds of the inner angle of the lid margin are the most serious because of the proximitity of the tear ducts. The cilia may also become displaced through injury, and give rise to considerable irritation. Wounds in the neighborhood of the eye should be treated antiseptically on account of the danger of infection or possible tetanus. Incised wounds of the lids should be thoroughly cleansed, and the edges of the wound brought together and sutured as early as possible. This is particularly true in vertical wounds where there is generally considerable

gaping. Lacerated wounds usually require simple antiseptic dressings, as they eventually slough, and the consequent deformity must be treated by operative measures.

In handling wounds of the bulbus, particular care should be observed that no pressure be exerted, unless it be indicated. Treatment, in so far as temporary care is concerned, consists in gentle cleansing about the eye, and the application of a bandage. Bed is indicated if the injury be severe; and cold applications, if the pain be distressing; in extreme cases it may be

Fig. 6. Lachrymal Probe.

necessary to administer an opiate. The bowels should also receive attention.

Burns of the lids are treated in the same way as burns of the general body. In case of alkali or acid burns, by neutralization if seen immediately; this to be followed by soothing ointments and a bandage. They may result in malposition of the lids owing to cicatricial contraction, and often require extensive plastic operations for their correction.

Lids

Hordeolum, stye, or palpebral boil, occurs usually in children, and is, as a rule, caused by general ill-health, infection,

refractive errors and eye-strain. It is simply a suppurative process in a hair follicle, beginning as a small, hard, painful nodule on or near the margin of the lid, the entire lid sometimes being red, swollen, and edematous. The usual course to suppuration and rupture is two or three days, although the process may be aborted by pulling out the hair and touching the point with 90 per cent carbolic acid, or tincture of iodine. This should be followed with hot applications, and the application of yellow oxide salve each evening at bedtime.

They are very apt to be recurrent unless the cause be removed. When suppuration is present they should be incised. No bandage is required.

Chalazion, Meibomian cyst, or tarsal cyst, usually occurs in adults. They are very likely to be multiple. They differ from hordeoli in that they develop in the lid itself, although the exciting cause is often the same. They consist in small, hard, slowly-developing, slightly-movable tumors of variable size, from that of a pea to that of a hickory-nut, and are imbedded in the tarsal cartilage about the middle of either the upper or lower lid. They are not painful except when infected, and the contents may be gelatinous, cheesy or purulent. They are usually evacuated through the conjunctival surface, either spontaneously or through operation, presenting before evacuation a purplish, slightly elevated area. The affection sometimes disappears spontaneously, but, as a rule, a hard lump remains for some time, even though the chalazion has been incised and thoroughly curetted. Following operation no dressing is required. Massage is usually performed at intervals of one hour during the day for some days following the operation.

Blepharitis marginalis is an inflammation of the lid margins usually of chronic nature, lasting sometimes for years. The eye-lashes are often totally destroyed. Eye-strain is a very important causative factor; or the condition may be a part of a general conjunctivitis—that produced by the Morax-Axenfeld bacillus being particularly prone to cause this affection in a chronic form. Crusts form, and the lids are agglutinated in the mornings. Ulcers may also form and the lids become moderately thickened. The treatment consists in thorough removal of the crusts after having soaked them with a 2 per cent solu-

tion of sodium carbonate (not bicarbonate), and of massage with 1 per cent to 4 per cent yellow oxide of mercury salve every evening before retiring. All refractive errors should be corrected, exposure to irritating atmosphere, smoke, dust, etc., should be avoided, and the general health should receive attention. It may be found necessary to remove the lashes, which, as a rule, grow in again. Silver nitrate solution 5 per cent is often painted on the lids two or three times a week.

Entropion is a turning in of the lid margins so that the cilia rub against the eyeball with consequent irritation. Turning in of individual lashes is called trichiasis. Entropion is usually the result of trachoma, a chronic infectious conjunctivitis, which causes contraction of the palpebral conjunctiva and consequent curvature of the lids with the convexity outward. This curvature of the lids may also be due to severe burns or injuries of the eye. The upper lid is most frequently involved. Various operations are devised for the relief of this condition. Temporary relief may be obtained by epilation, and also by the application of adhesive plaster or collodion to draw the lid away from the eyeball, although this is only practicable where the lower lid is concerned.

Ectropion is the opposite condition from the one just described, and consists in a turning outward of the lid so that the margins are no longer in contact with the bulbus. It is usually due to the formation of scar tissue, and involves chiefly the lower lids. The lax tissues around the eye in old people are often responsible for this condition. The lacrymal puncta are pulled away from the eye so that the tears run over the cheek; and the conjunctiva is also exposed to all sorts of irritation. Various operative measures may be resorted to for remedying the condition. It is well to caution old people to wipe the eyes toward the nose instead of away from it, as is customary. Massage of the lid toward the nose may also be resorted to as a curative measure.

Edema, or swelling of the lids, is usually due to inflammatory conditions, although the puffiness of the eye-lids in kidney affections, general depletion, and neurotic disturbances, is familiar to all. Edema is not to be confounded with fat deposits in the lids, which very closely resemble it. The phenomenon

known as crepitus, and the history, differentiates the presence of air in the tissues; in this latter condition the swelling is made worse by blowing the nose. Treatment consists in the removal of the cause and the application of a pressure bandage.

Ecchymosis, or ordinary "black eye," is a discoloration following contusions, and is due to the extravasation of blood into the cellular tissue. Treatment consists in the application of cold and leeches, or in incision of the skin to evacuate the blood clot. Immediate treatment is imperative, otherwise one must wait for the process of slow absorption. Water colors may be applied for their cosmetic effect.

Ptosis is a drooping of the upper lid, either one side or both. It may be congenital, when it usually affects both eyes; or it may be due to paralysis of the nerve supplying the lid; it may also be due to inflammatory conditions resulting in thickening of the lids, and to adhesions; still further it may be due to wounds. The lid may be supported by various appliances, wires, monocles, etc., but operative treatment is, in the end, the only positively effective course.

Paralysis of the lid may be independent of or a part of a general facial paralysis. In paralysis of the orbicularis it is not possible to close the lid of the affected side; and in paralysis of the levator palpebrarum it is not possible to elevate it.

Conjunctiva

Non-communicable affections.

Subconjunctival hemorrhages, or ecchymoses, appear as smooth, red patches underneath the conjunctiva, being bright or dark-red according to their age. They may involve from one-quarter to one-third of the scleral surface, and are not at all painful. They are usually discovered upon the patient's looking into a mirror; or his attention is called to the condition by someone else. Straining, vigorous sneezing, coughing, or some similar exertion is, as a rule, the cause, and they are of no significance except as an indication of fragile vessel walls. No treatment is required, and they disappear gradually in a week or more.

Simple hyperemia, or injection. This is simple redness of the conjunctiva with no discharge. The lid margins may also be involved. There is often a feeling as if sand were in the

eyes, and also burning, smarting and itching. The cause is usually some error of refraction, with consequent eye-strain; exposure to wind, dust and smoke; loss of sleep; or extension of a coryza from the nose. This condition may be the first stage of acute conjunctivitis. Treatment consists in removal of the cause. Local applications of cold several times a day are effective. These should not make the head ache. Hot applications may be more grateful and are often quite as effective. Following the application, the instillation of non-irritating antiseptic drops is recommended—boric lotion or argyrol 10 per cent.

Acute catarrhal conjunctivitis. This is an aggravated form of hyperemia combined with a muco-purulent discharge. The causes are the same. The symptoms are swelling, burning, feeling of sand in the eye, lacrymation and photophobia. The discharge is at first serous, and then muco-purulent. The lids are agglutinated in the morning, and the secretions dry on the lid margins. The discomfort is worse in the evenings. Treatment is the same as that for hyperemia. Agglutination of the lids is prevented by smearing their margins with a simple salve, such as sterile vaseline, before retiring.

Follicular conjunctivitis. This affection, which usually occurs in young people, and is often attributable to faulty hygiene, belongs to catarrhal conjunctivitis, having as an additional feature the over-development of the lymph follicles. The conjunctiva of the lids shows pale, round, translucent granules, often arranged in rows parallel to the lid margin. They are most abundant in the lower fornix. Symptoms are not usually pronounced. There may be a catarrhal secretion, and agglutination of the lid margins in the mornings; also some photophobia and itching. The course is chronic, although the affection may disappear spontaneously. Treatment is similar to that for hyperemia. A special salve, which is eminently useful, is dilute citrine ointment, made with unrefined or brown cod liver oil as excipient; this is again diluted with refined cod liver oil, 30 per cent to 50 per cent. A small quantity is placed in the lower cul-de-sac and the lids massaged according to the method described previously. This is done every other day until improvement takes place, and then the interval is widened.

The excess ointment should not be washed off for an hour or two afterwards.

Phlyctenular conjunctivitis. This is one of the most common forms of conjunctivitis found among the poorer classes, particularly children. The lesions are small elevations or "pimples," situated usually near the margin of the cornea in the conjunctiva, each one forming the apex of a triangular leash of vessels on the bulbar conjunctiva. The appearance is very characteristic. The condition begins with smarting and burning of the eyes, photophobia and lacrymation; the child prefers the darkness, and keeps the lids tightly closed. There are usually eczematous eruptions around the canthi, nasal orifices, and perhaps on the face and general body. Enlarged glands are probably also to be found, as well as a general strumous condition of the body. Blepharitis, and fissures at the outer canthi, are quite characteristic. The disease recurs frequently. Treatment is directed toward the general health; diet, bowels, and general bodily cleanliness should receive attention. The child should be kept in the open air as much as possible. Dark glasses should be worn for protection from light and foreign bodies, but no bandage should be applied. As to medicinal treatment, the insufflation into the conjunctival sac of pure calomel powder is perhaps the most effective. This is contraindicated where potassium iodide is being taken internally. In addition to this, yellow oxide salve should be applied to the lid margins. Both these applications may be made once daily. For the blepharospasm, stretching of the lids by means of retractors, and dashing the face in cold water, are perhaps the most effective. The blepharospasm usually disappears quite promptly, however, as soon as the disease begins to show signs of improvement.

Communicable diseases.

Great care should, very obviously, be observed in handling these cases that none of the secretion may reach the eyes of the examiner, care being also observed that articles coming in contact with the secretions are properly disinfected or destroyed. A bacteriological examination is really required to determine the exciting cause, although some of the affections

have some very characteristic symptoms. It is always best to be cautious when caring for any inflammatory condition of the conjunctiva. Many micro-organisms are normally present in the conjunctival sac. A smear for bacteriological examination is taken from the conjunctival sac by everting the lower lid, directing the patient to look up, and removing a small particle of the secretion from the lower fornix with a sterilized platinum needle. Disposition of the specimen for subsequent examination is as in general bacteriology.

Acute catarrhal conjunctivitis, or "pink eye," is an affection due to the Koch-Weeks bacillus. It occurs usually in the spring and fall, and is frequently epidemic. The lid margins are red and slightly swollen, and are slightly agglutinated in the mornings; there is also a collection of a small quantity of muco-purulent secretion at the angles of the lids. The ocular conjunctiva becomes deeply injected about two days after infection; the conjunctiva of the lids is deeply red and swollen, and gives a succulent appearance. There is a sensation as of foreign body in the eye; also burning and itching of the lids. In addition to these symptoms, there is photophobia and discomfort, and sometimes pain. Slight hemorrhages make their appearance occasionally, being located in the conjunctiva of the bulbus. The discharge, as has been noted, is muco-purulent, and is usually quite ropy; it is sometimes altogether purulent. The affection gradually subsides after a week or ten days; its height is on about the third day. Constitutional symptoms may develop. As a rule, one eye alone is affected, unless treatment has been neglected, in which case both are involved. In the matter of treatment, aside from the usual cold applications, which may be made in the shape of ice pads, if desired, the use of silver nitrate is perhaps the most effective; this is applied in the form of drops of a 1 per cent solution, one drop three times a day, or less frequently if the reaction be too pronounced. Protargol or argyrol may be used in place of silver. The cold applications should be discontinued as the acute stage subsides.

Angular conjunctivitis. This is an infection with the Morax-Axenfeld bacillus, or "diplo-bacillus," as it is called. The affection almost always attacks both eyes simultaneously.

The catarrhal symptoms are milder than in the affection just described. There is a moderately abundant, grayish-yellow, rather tenacious secretion, which accumulates during the night, and particularly at the inner angles of the eyes—hence "angular conjunctivitis." The lid margins become red, but chiefly at the canthi. The mucous membrane of the lids shows, as a rule, only moderate swelling, and the conjunctiva of the bulbus is generally only slightly involved. The condition is often confused with marginal blepharitis. The treatment is the same as for the affection last considered, except that in this affection the specific remedy is zinc sulphate, usually in ½ per cent solution, or zinc chloride ¼ per cent solution. This must be continued for weeks, and possibly months, as the course is very chronic.

Pneumococcus infection. The intensity of this infection is variable; severe cases resemble gonorrheal infection of the eye, and mild cases resemble simple catarrh. It usually begins with slight edema of the lid margins, particularly the upper. Quite characteristic is the fact that the injection is more intense in the lower half of the conjunctiva of the bulbus, and that numerous hemorrhagic spots develop therein. The discharge may be profuse, the lids intensely swollen, and the infection present a very angry appearance. In many cases there seems to be a sort of crisis, after which the symptoms rapidly subside. There is often a severe rhinitis occurring simultaneously with the conjunctivitis, the latter probably being dependent upon the former. It is a very dangerous affection where corneal abrasions are present. Treatment consists in the application of cold, and silver nitrate 2 per cent (or argyrol or protargol), preceded by irrigation with boric lotion.*

*It is difficult to draw a sharp line of distinction between severe forms of acute catarrhal conjunctivitis and purulent conjunctivitis, as all gradations exist. In the latter case the chemosis (edematous swelling of the conjunctiva around the margin of the cornea) is greater, the discharge is more profuse and more purulent in character, the lids are tense and swollen, ulceration of the cornea is more frequent, and the inflammation extends to the deeper structures. In the more severe cases the gonococcus of Neisser is found, although the mixed infection is more dangerous than the simple infection with gonococci.

Ophthalmia neonatorum. As a matter of statistical interest it might be mentioned that at the last census there were found to be 60,000 blind in the United States, and of these one-quarter, or 25 per cent, were rendered so by infection with the gonococcus of Neisser. This refers alone to the totally blind; the number of those rendered partially blind from this cause would probably reach astonishing figures. Since the introduction of the method of Credé the percentage of those affected by this disease in the hospitals has been reduced to but a fraction of 1 per cent.

Ophthalmia neonatorum is an acute infectious inflammation of the eyes, one or both, with copious discharge of pus, infiltration of the subconjunctival tissue, and, in a majority of cases, involvement of the cornea. Infection usually takes place during the passage of the child's head through the vagina, and symptoms almost invariably show themselves on the third day after birth. If it occur later than this, the infection is probably conveyed to the eyes by means of the towels, fingers, cloths, etc. One eye is usually affected a day or two preceding the other. There is almost always a history of the mother's having had leucorrhea, or of the father's having gleet, or having contracted an acute gonorrhea. There is another form which sets in when the child is four or five days old, runs a mild course, and resembles very much a simple acute catarrhal conjunctivitis.

The severe form begins with slight redness of the conjunctiva of the lids, and a small amount of discharge resembling serum, which accumulates in the corners of the eye. This soon becomes creamy, secretes rapidly and flows over the cheek. It may become yellowish-green and tinted with blood. The redness soon increases, the lids become shiny and swollen; so swollen, in fact, that the upper lid falls down and covers the margin of the lower lid. The skin shortly afterwards becomes tense and hard and of a dusky-red color. It is almost impossible to evert either lid; retractors must be used. The conjunctiva is now very red and much swollen, and presents a velvety appearance. The congestion rapidly extends to the conjunctiva of the bulbus, which becomes intensely red and edematous; chemosis usually develops, so extreme as to overlap the cornea

for a considerable distance. A false membrane sometimes forms on the conjunctival surface. This is difficult to strip off and leaves a bleeding surface behind, thus resembling the membrane of diphtheria.

As the affection subsides the swelling gradually diminishes; the lids become less tense; creases begin to form in the skin. The conjunctival surface remains thickened; the ocular conjunctiva falls into folds. The discharge becomes thin and less copious, but may be still occasionally tinged with blood. The course is usually about six weeks. The chief danger is involvement of the cornea, this involvement beginning particularly at the margins where the chemotic conjunctiva overlaps, although it may begin in the center. The cornea becomes hazy, dull and lustreless; ulcers form and rapidly spread; and the entire cornea may become involved and be totally destroyed in the course of one day. The iris frequently prolapses through the floor of an ulcer, becoming permanently adherent to the margins of the perforation. In the milder form resolution may occur with retention of good vision even in the presence of corneal ulcers. In poorly nourished infants the affection is particularly severe. The cornea may be rendered wholly opaque, (a condition often seen and usually called "cataract" by the laity); and may even bulge forward through the lids, presenting a very repulsive appearance. The entire eye may be lost through panophthalmitis.

Treatment. Prophylaxis. Where a discharge from the vagina is known to exist, the parts should be thoroughly cleansed with antiseptic solution every day for a considerable period preceding the birth. The method of Credé is our most valuable means of prevention. This is as follows: Immediately upon the birth of the head, the lids should be wiped dry with a piece of sterile gauze, the eyes should be carefully opened, and, with a medicine dropper, one drop of a 2 per cent solution of silver nitrate instilled into the lower cul-de-sac of both eyes. Since the introduction of this method the percentage of cases has been reduced from approximately 10 to 0.2 per cent.

Cleanliness. Even though no vaginal discharge be present, the eyes should be carefully looked after for some time follow-

ing birth. Daily cleansing with sterile water or some antiseptic solution may save much suffering and perhaps loss of sight. Above all things the hands of the nurse or attending surgeon should be carefully cleansed before touching the eyes of an infant; and nothing but sterile cotton or gauze should be used for wiping the eyes. Great care should also be exercised by the examiner that none of the secretion reach his own eyes, either by means of hands, gauze, cloths, dressings, etc., or by the spurting of the secretion into his eyes when the lids of the patient are forced open. This is of very frequent occurrence.

Irrigation with boric lotion should be frequent in order that the secretion may not collect and remain in the conjunctival sac. Use great care not to touch the cornea with the syringe, as an abrasion of the cornea in the presence of an infection will almost certainly prove fatal to the sight. Evert the lids and irrigate thoroughly the upper and lower cul-de-sacs, stopping from time to time to wipe away, with pledgets of gauze, or moist sterile cotton, any discharge adherent to the conjunctiva. Repeat every hour or two according to the severity of the case. In using the fountain syringe, elevate the bag no more than three inches above the level of the child's face. The point of the syringe is held about an inch from the eye. The lids are drawn apart with the fingers, applying them as far away from their margins as possible. Irrigating retractors may also be used. Observe great care not to injure the cornea.

Iced applications may be used every hour or two for ten or fifteen minutes at a time, provided there be no corneal involvement.

As the disease becomes more advanced the discharge becomes thicker and more copious. Silver nitrate solution 1 to 4 per cent is then applied to the palpebral conjunctiva once or twice a day, or a 2 per cent solution simply dropped into the eye where eversion is impracticable. First the lid is carefully everted, the discharge thoroughly removed and the mucous membrane dried. By means of a cotton applicator the silver solution is now painted over the surface, following this with normal salt irrigation. Protargol 10 to 20 per cent, or argyrol 20 to 40 per cent, may be substituted for the silver nitrate.

The so-called argyrol bath may be given. This consists in dropping into the eye a 10 per cent solution of argyrol, every fifteen minutes, throughout the day and night, for a day or two. This can be done without disturbing the child's sleep.

Atropin solution 1 per cent is instilled in case of corneal involvement, and should be employed often enough to keep the pupil fully dilated. Ice compresses must be stopped and replaced by heat when the cornea becomes involved, observing the precaution to apply vaseline to the region about the eye in order to avoid burning of the delicate skin.

Fig. 7. Buller's Shield.

Buller's Shield. In case one eye alone be involved, the unaffected eye should be protected by the so-called Buller's shield; although it is rather difficult to keep this in place in the case of infants. In any case, it is best to keep the patient lying on the side affected to prevent the secretion from running into the other eye or contaminating the dressing of the sound eye. The idea of the shield originated with von Graefe, and consists in the application of a thin watch glass or piece of isinglass, about two and one-half inches in diameter, to the unaffected eye, and holding it in place by adhesive plaster. It was popularized by Buller. This allows the patient to see out of the eye, and also allows the surgeon or nurse to inspect the eye without touching the dressing, thus lessening the danger of infection.

A slight catarrh is quite frequently set up in the sound eye, this being manifested by a moderate mucous discharge; and the glass may become steamy. This latter difficulty may be avoided by leaving a little opening at the lower outer corner of the dressing, so that air may enter. A little rubber tube can be inserted under the plaster at this point, as shown in the illustration.

There are various methods of applying this protective shield, but the description of one is sufficient. The margins of the glass are protected by adhesive plaster. Take a piece of adhesive plaster about three and one-half inches square, cut to a circular outline, one-quarter of an inch larger than the watch-glass. Then cut a hole in this about one-quarter of an inch smaller than the watch glass. Now remove the protective gauze and attach the adhesive plaster to the convex side of the glass, slitting the margins slightly in several places in the circumference, and folding them under on the concave side.

The circles can be much more accurately cut if the outline of the watch-glass is traced on the plaster with a pencil. The plaster is then folded once with the traced surface out and cut accordingly.

Now prepare another piece of adhesive plaster considerably larger than the other, but cut square, and with a hole in the center corresponding to that in the first piece; i. e., about one-quarter inch smaller than the watch-glass. This is also attached to the convex side of the glass. In this instance, however, the margins are not folded under, but are attached to the brow, the side of the nose, and cheek; the irregularities of the orbit having first been padded out so that the glass rests evenly against the surface. Particular attention should be paid to having the plaster closely applied on the nasal side, as in this place there is the greatest danger of the secretion gaining access to the sound eye. Isinglass may be used instead of the watch-glass; and, in place of adhesive plaster, collodion may be used, although it is perhaps not so easily applied.

This dressing may be worn for many days without change, as long as the eye shows no signs of sharing in the infection, or unless the skin become irritated by it. It is perhaps more

practical in cases of gonorrheal ophthalmia in the adult.

Gonorrheal ophthalmia. This condition is practically the same as the preceding. It is due to direct infection with the discharge from gonorrhea or gleet, carried by means of the fingers, towels, etc., which have become contaminated. In from one to three days following infection of the eyes, the lids become red and swollen, and there appears a discharge of watery consistency resembling meat-juice or serum. The conjunctiva becomes red and turgid; the swelling rapidly increases. The lids become tense and hard, are separated with difficulty, and cannot be everted. The upper lid often overlaps the margin of the lower. The conjunctiva now assumes a dusky-red color and soon becomes chemotic, sometimes protruding through the lid fissure. The pressure on the margin of the cornea often interferes with nutrition. The swollen lids are very painful on pressure, and there is a sensation of smarting, burning, and foreign body. The discharge soon becomes thick and purulent, resembling thick cream, and is often tinged with blood. It runs out from between the lids onto the cheek. In extreme cases the conjunctiva becomes thrown into folds, and is sometimes covered with a membrane which leaves a bleeding surface when removed.

The symptoms subside in a week or ten days. The turgescence and tumefaction of the lids diminishes, and little creases appear, showing the relaxation of the skin. The discharge becomes less abundant; the pain is not so marked; and the chemosis of the conjunctiva disappears. The conjunctiva presents a velvety appearance, and bleeds upon being touched. The conjunctiva of the lids is roughened and covered with granulations after the swelling has subsided. The secretion becomes thin and gradually disappears. The hyperemia remains for a considerable time.

Involvement of the cornea is usually during the stage of swelling and edema. It becomes dull and lusterless. Total destruction sometimes occurs, and perforation with prolapse of the iris is not uncommon. The eye may be entirely lost with panophthalmitis.

The prognosis is grave. The symptoms follow one another

rapidly. The cornea may be totally destroyed in a few hours. Vision is always impaired to a greater or less degree when the cornea has taken part in the process.

Treatment. This is primarily prophylactic. If one eye become infected, protect the sound eye with Buller's shield. Iced applications should be made almost continuously. The conjunctival sac should be carefully irrigated with boric lotion every one-half hour; or bichloride alone, 1-10000, or formalin, 1-5000, may be used instead. All the discharge should be washed away, particular care being taken that all parts of the cul-de-sac are reached by the irrigating fluid. Later on, when the secretion is more profuse and purulent, and the lids less swollen, silver nitrate may be applied, as described under ophthalmia neonatorum. In fact, the whole treatment is practically the same.

All dressings and all cloths, etc., of no intrinsic worth, which are contaminated with the secretion, should be immediately destroyed; and all instruments, etc., should be thoroughly sterilized after each dressing.

Trachoma. This is a serious, intractable, and destructive infectious disease of the eye. It is characterized by the formation of granules—therefore called "granular lids." The name is often misapplied, however, as it is used by the laity for almost any inflammation of the eyelids. Upon healing, marked cicatrization usually takes place.

There are two forms, the acute and chronic. The acute form is characterized by great swelling and injection of the palpebral conjunctiva and cul-de-sac. The discharge is sometimes purulent in character. Ulcers may form on the cornea. Accompanying the condition is considerable pain, lacrymation, and photophobia.

The chronic form may set in without any discomfort at all. The patient complains simply of itching and sensation of foreign body in the eye, or of slight smarting of the lids. These symptoms are aggravated by exposure to wind and dust, or prolonged use. The symptoms gradually become more pronounced as the disease advances. Eversion of the lid shows the conjunctival surface covered with granulations which resemble sago grains. In the early stage these may be limited almost entirely

to the upper cul-de-sac. They appear to be embedded in the conjunctiva, above the surface of which they project. The disease may last for years or for a lifetime, and result in deformity of the lids from cicatrization, and loss of sight from the condition known as pannus, or as result of corneal ulcers.

It is transmitted chiefly by the secretion, and consequently great care should be used in handling such cases that none of the secretion reach the eyes of the nurse or surgeon.

The treatment resembles very much that used in gonorrheal inflammations, although copper occupies quite an important place in the therapy. Perhaps the best and most certain method of treating the chronic disease is by means of expressing the granules through operative procedures.

Injections of the eye, deep and superficial.

Deep injections of the eyeball are due to inflammations of the cornea or of the deeper structures, while the superficial injections are either purely local manifestations or are present in association with the deep ones. Superficial injections may, therefore, be called conjunctival, and deep injections, bulbar. They may be considered differentially as follows:

	CONJUNCTIVAL.	BULBAR.
Vessels.	Individual vessels of large and small size.	Not recognized as individual vessels.
Color.	Scarlet or brick red.	Diffuse rose red, or pale violet (owing to deep situation of vessels).
Movement.	Injected conjunctiva can be moved over the sclera.	Injection of globe does not change position with movement of conjunctiva.
Area involved.	Usually spread over the whole conjunctiva.	Usually confined to zone surrounding cornea, a few millimeters wide, fading toward periphery.
Occurrence.	Conjunctival affections, infections, eye-strain, foreign bodies.	Deep inflammations, iris, ciliary body.
Vision.	No impairment as a rule.	Impairment usual.

The following table of differentiation may be of assistance in deciding about the importance of certain symptoms. Iritis, for instance, is a dangerous condition, while conjunctivitis does not usually leave any impairment of vision, unless, of course, the cornea has been involved.

	IRITIS.	CONJUNCTIVITIS.
Pain.	Often severe, worse at night; felt in and above the eye.	Not usual. Smarting, burning, foreign body.
Photophobia.	Marked.	Variable.
Redness.	Pericorneal.	General.
Pupil.	Contracted, sluggish or immobile. Iris markings indistinct.	Unaffected.
Anterior Chamber.	Cloudy.	Unaffected.
Lids.	Not usually affected.	May be swollen. Adherent in the morning.
Discharge.	Watery.	Mucous, or muco-purulent.

As a sort of resumé of the various symptoms given, the following easy method of diagnosing the commoner forms of inflammation of the eye, may be added. This is a slight modification of the method of Fenwick *(Medical Diagnosis).*

Redness is common to most inflammations of the eye, deep and superficial.

(A) Eyeball wholly or partially reddened without discomfort or other symptoms, as, for instance, subconjunctival hemorrhage.

In this case there is no discharge, the redness is localized, a deep-red, smooth, uniform patch obscuring the scleral vessels. No treatment is necessary.

(B) Eyeball reddened and uncomfortable, but no marked pain.

Hyperemia. The lining of the lids is redder and rougher than normal. There is slight smarting and burning, and itching of the lids; also sand and foreign body sensation. Very little

secretion except at the inner canthi. Lid margins occasionally agglutinated in the mornings.

Foreign bodies. Constant scratching, foreign body sensation. History.

Phlyctenules. Elevated points on surface of globe, usually near corneal margin. Forms apex of triangular leash of vessels. Recurrent. Photophobia, lacrymation. Eczematous eruptions. Evidence of malnutrition.

Acute and chronic conjunctivitis. No distinct pain. Smarting and burning. Foreign body sensation (not constant). Mucous, or muco-purulent discharge on lid edges and at inner canthus. Lids agglutinated in mornings. Injection and swelling of conjunctiva. Does not equally extend clear up to the corneal margin. Tension of the eyeball normal, and rarely tender to touch.

(C) Eyeball red and painful.

Iritis. Redness at first confined to corneal region of ocular conjunctiva. After a few days all the vessels of the globe are engorged. Photophobia, lachrymation. The eyeball is tender to the touch. Pain is worse toward the evening and at night. May radiate over corresponding side of head. The tension is rarely increased, and the pupil is contracted.

Glaucoma. The tension is plus (increased) during attacks of pain which are of neuralgic nature, extending along the course of the supraorbital nerve. It is, therefore, apt to be mistaken for supraorbital neuralgia. The eyeball is injected, the cornea hazy. The pupil may be normal but is usually dilated during the attack. The vision is usually lowered. There is little secretion. Photophobia is slight. Rainbows are often seen around lights. Constitutional symptoms such as nausea, vomiting, restlessness, are usually present.

Phlyctenules of the cornea. Usually in children. Often accompany phlyctenular conjunctivitis. The symptoms are very characteristic. Photophobia, lachrymation, blepharospasm, snuffles. Ulcers, which are very frequently central, may be detected by staining with fluorescin, preceded, if necessary, with a few drops of cocain 4 per cent to quiet the eye.

Scleritis and *Episcleritis.* Rarer. Pain is variable. Isolated, smooth, raised, purplish patch on the globe. Nearly always rheumatic. Leaves purplish stain on the eyeball. Little or no secretion in this affection.

Ocular neuralgia. Other branches of the trigeminus also affected. May occasion slight reddening of the eye. Usually unilateral. Not accompanied by lachrymation, mucous discharge, or increased tension. Does not affect the sight.

Gonorrheal ophthalmia. Swelling of the lids. Profuse purulent discharge, at first thin and serous, resembling meat-juice. Intense injection and edema of the conjunctiva. History of gonorrhea.

Ocular Headaches and Eye-Strain

Probably not less than forty per cent of all headaches or ocular discomfort depend directly or indirectly upon organic or functional disorders of the eye. Seventy-five per cent of all frontal headaches are due to eye-strain. These depend chiefly upon the efforts of the ciliary muscle to correct abnormalities in refraction. Irritation of the center for the fifth nerve causes pain to be referred to the end filaments in the forehead; and irritation of the nuclei of the third nerve causes dull pain in the eyeballs themselves and in the parts behind them. This may be due to faulty ventilation. In chronic cases the whole front of the head may ache. The pains of eye-strain are invariably bilateral. The exciting cause is usually some form of near work, such as reading, or sewing, drawing, music, stenographic work, etc.; or looking into a bright light, at the snow, or a bright reflection from the water or pavement. Following the order of frequency, the headaches are located as follows: Supraorbital, deep orbital, fronto-occipital, and temporal. A headache located on top of the head usually points to affections in the pelvis. Unilateral headache, or a hemicrania of any kind, is not commonly due to eye-strain. The headache does not always immediately follow excessive use; it may not be noticed until the next morning. However, as a rule, the eyes and head commence to ache after a certain number of minutes or hours of close application. It is quite often regular in this respect, so that the patient will himself attribute his difficulty to the eyes. Headache is often complained of after an

evening at the theater, church or concert, riding on the train, or after shopping. In the latter case, particularly, there is great demand made on the ocular muscles in keeping a sharp lookout for cars and vehicles when crossing the street. Close examinations of cloths and articles in a poorly lighted store is also many times responsible. The general nervous strain to which the individual is subjected must not be overlooked. Healthy eyes do not suffer so much as those incapacitated by disease or refractive anomalies. Of other symptoms accompanying the headache, or appearing alone, may be mentioned the following manifestations of eye-strain: Twitching of the lids, smarting, burning, lacrymation, photophobia, congestion, ocular discomfort, drowsiness, and blurring and running together of letters after a variable period of reading or near work (a few minutes to an hour or more). An individual may have a purely ocular headache with vision clear and apparently normal, and the eye presenting absolutely no external evidence of disease. Imbalance of extrinsic muscles of the eye, in association with refractive errors, is also cause of ocular headache. Supraorbital headache may also be due to nasal conditions. It differs from ocular headache in that it continues during the night while the eyes are at rest, and is worse on taking cold. Purely ocular headache is not usually made worse by taking cold, and, as a rule, ceases when the patient has retired and the lights in the room are extinguished. Headache from iritis, glaucoma, and other diseases of the eye are usually recognized by the presence of the causative affection.

One other form of headache, migraine, is not necessarily due to affections of the eyes, although the symptoms often point to the eyes as the source of the difficulty. This form of headache is frequently preceded by aura just as in epilepsy, and a history of the condition in other members of the family, particularly the parents, can usually be obtained. Preceding the headache there often develops, in the center of the visual field, an irregular zigzag, cloud-like margin, usually edged with color, leaving blindness behind it as it progresses, and gradually spreading out in all directions toward the periphery. Transient total blindness results, and this is followed by severe unilateral

headache lasting for a few hours or for a whole day. The condition is apparently relieved by vomiting. The affection disappears with advancing years, and treatment is of little avail.

Treatment of ocular headache. The eye-strain should be relieved by appropriate glasses; attention should be paid to the general health, on account of its direct influence upon the eyes; insomnia, and dyspepsia, especially the toxic form, should receive proper treatment; too much eating should be avoided, and proper and sufficient exercise taken. Alcohol, tea and coffee in excess are, of course, contraindicated as in any condition. Local measures consist in the application of heat or cold, whichever is the more grateful to the patient; these are made, according to the method described later, at intervals of fifteen seconds for a period of five minutes, and repeated several times daily. They must be stopped if any pain or discomfort be produced. They may be repeated every hour or oftener if the headache persist. Various collyria are recommended, but probably as effective as any is a boric lotion. Local massage over the temples may also be performed with some evaporative lotion, such as camphor, menthol, etc.

CHAPTER IV.

THERAPEUTICS AND MINOR PROCEDURES.

General Rules

While the preparation of the more complicated drops and solutions for use in the eye will ordinarily be left to the pharmacist, it will often be necessary to make up the simpler ones. In view of this fact the following tables are appended:

For the preparation of ounce solutions to be used as drops, the following will be helpful. The percentages also apply to the preparation of salves:

1⅛	grain to the ounce=	¼ per cent
2¼	grains to the ounce=	½ per cent
4½	grains to the ounce=	1 per cent
22½	grains to the ounce=	5 per cent
45	grains to the ounce=	10 per cent

For the preparation of solutions:

1-½	grains to the pint=	1/50	per cent, or 1 to 5000
7 1-3	grains to the pint=	1/10	per cent, or 1 to 1000
73	grains to the pint=	1	per cent, or 1 to 100
146	grains to the pint=	2	per cent, or 1 to 50
219	grains to the pint=	3	per cent, or 1 to 33
292	grains to the pint=	4	per cent, or 1 to 25
365	grains to the pint=	5	per cent, or 1 to 20
780	grains to the pint=	10	per cent, or 1 to 10

Domestic Measure. Only approximate. Not to be used in the preparation of powerful drugs.

Liquid.

Teaspoonful ...=1 fluid drachm (60 minims)
Dessertspoonful = 2 fluid drachms (120 minims)
Tablespoonful .= ½ fluid ounce (240 minims)
Wineglassful ..=1½ to 2 fluid ounces (720 to 960 minims)
Teacupful .....=4 fluid ounces
Tumblerful ....=8 fluid ounces

Solids.

Teaspoonful (heaping) boric acid.....=1 drachm
Teaspoonful (level) sodium bicarbonate..=1 drachm
Teaspoonful (level) salt .....=1 drachm

Eversion of the Lids

Before entering into the consideration of therapeutics, it is necessary that one be familiar with the methods of everting the lids, which knowledge is quite essential not only to the proper application of the various drugs used in the conjunctival sac, but also to inspection of the conjunctiva itself. Other procedures will be taken up, as the necessity for them is indicated, when considering various substances, such as lotions, drops, salves, etc.

The lower lid is, of course, the easier of eversion. The patient is instructed to look up. The tip of the thumb or forefinger is placed at the margin of the lower lid, and the lid is simply drawn downward. While still exerting pressure, the finger may be slid along the lid toward the outer canthus, and the conjunctiva of the lower fornix, or cul-de-sac, thus be brought into view. If the orbital fat be not too abundant, quite a sac will be formed if the patient look down or straight ahead while the thumb still maintains its pressure on the lower lid. The large sac thus formed is often of great advantage in the application of ointments and drops to the eye, as will be explained later on. In releasing the lower lid, observe that none of the lashes remain turned in by being caught by the lashes of the upper lid.

Eversion of the upper lid is a rather more difficult procedure, and one very discouraging to attempt if one does not fully understand the method of performing it.

First of all *THE PATIENT MUST LOOK DOWN*, and continue to do so until instructed to do otherwise. If he does not, it is almost a physical impossibility to evert the lid; and if difficulty be experienced one may be almost certain that the patient is not obeying the instruction to look down. It is often necessary to direct his attention to some specific object such as his feet, or his hands, or the floor. One should stand behind the patient, who is seated; his head rests against the body of the one performing the eversion. Assuming the right upper lid

is to be everted the forefinger of the left hand is placed on the upper lid just below the eyebrow, and the lid is drawn by the finger tip up and away from the eyeball so that the cilia point almost upward. These are then grasped by the thumb and forefinger of the right hand, without touching the globe, and the lid is drawn down and away from the globe, while the forefinger which was in position below the brow is slipped to the upper margin of the tarsal cartilage and pressed downward toward the eyeball. The pressure must be made in the exact

Fig. 8. Everting Upper Lid—First Step.

center of the tarsal margin or the procedure may not be successful. With the left forefinger in this position, the lid is now elevated by making traction on the cilia, at the same time slipping the left forefinger out from behind the lid. The lid may be held in position by placing the tip of the finger against its margin.

When through with inspection or the application of remedies, direct the patient to *LOOK UP*, and the lid will quickly resume its original position, with perhaps a little assistance in the way of pressing the lid margin down. In case the lids be greasy, or moistened with tears or secretion, they must, of course, be cleaned before attempting to evert them.

If one desire to inspect the upper cul-de-sac more particularly, this may be accomplished by introducing a flat glass rod or spatula into the sac formed by the skin of the upper lid

when it is in the everted position, and pressing the point down so that it causes the conjunctiva to come into view. The patient must look down as far as possible. As the point of the rod is slid along the bottom of this internal sac, all parts of the conjunctival surface can be inspected. (The thumb or forefinger may be used in place of the glass rod in appropriate cases.)

Fig. 9. Everting Upper Lid—Lid Held in Position.

If the lid is to be everted from in front, as, for instance, when a patient is lying in bed, somewhat the same procedure is carried out. Assuming eversion of the right lid. The patient is instructed to look down, the fingers of the left hand are rested upon the forehead, the lid is now drawn upward by the tip of the thumb of the same hand, and the cilia which are thus made easily accessible are seized by the thumb and forefinger of the right hand, as above, and the lid drawn down and away from the bulbus. Pressure is now made on the tarsal cartilage by the thumb of the left hand, which is slid out from behind the lid as upward traction is made on the cilia. In seizing the cilia with the right hand, the palm is turned downward in this case, instead of upward as in everting from behind.

The lid may also be everted with one hand alone if the ordinary method fail, as it sometimes does, for instance in the case of deep-seated eyes. The patient looks down. The tip of the forefinger of the hand on the corresponding side is placed

in a position about midway on the margin of the tarsal cartilage, the finger being held parallel with the lid margin. Slight pressure is made to evert the cilia. The ball of the thumb of the same hand is now placed underneath the cilia on the margin of the lid, and as the thumb is elevated, the forefinger is depressed and at the same time slid out from behind the lid. It is simply a motion as of snapping the fingers, and is not difficult to perform. It is done with particular ease in cases where eversion has been frequently performed, or where the

Fig. 10. German Method—Examining Children.

muscles are very flaccid. The use of a toothpick, match, or rod of any kind in everting the lids is superfluous, disagreeable to the patient, and not unattended by danger. The key to the whole situation is simply for the patient to *LOOK DOWN*. This does not, of course, apply to refractory children, where other methods must be used. In such cases the child must be placed in the recumbent position and held there. This is the so-called "German method," and is accomplished in the following manner: A towel is thrown over the lap of the exam-

iner between whose knees the child's head is firmly fastened, face up. The body of the child lies in the lap of an assistant, who holds its hands with his hands and fixes the body and feet with his elbows; or the child may be enveloped in a sheet if its resistance be too vigorous. The separation of the lids is accomplished by placing the tip of the thumb near the margin

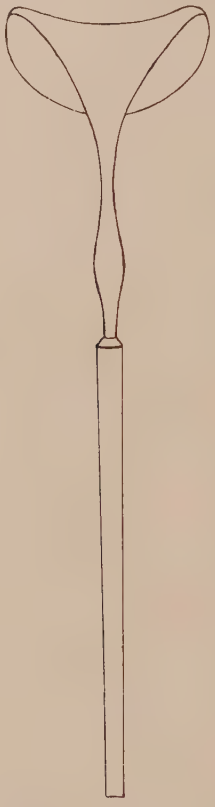

Fig. 11. Lid Retractor.

of the lower lid, and that of the other near the margin of the upper lid, and drawing the lids apart; or, if the case demand it, placing the thumbs immediately on the margins of the lids, and separating them. It is, however, wisest to apply the thumbs as far away from the bulbus as possible, owing to the danger of exerting injurious pressure.

In case one hand must be free in order to make an appli-

cation, the lids can be separated almost as well with the thumb and forefinger of one hand. Retractors are often necessary in extremely unreasonable patients. These consist in a curved, flattened hook on a handle about four or five inches in length. This hook-like extremity is inserted underneath the lid and traction made on the handle. The handles are also made in tubular form and can be attached to a fountain syringe; the solution passes out through minute perforations in the margin of the flat, hook-like extremity. Great care must be exercised in the use of these instruments that no injury be inflicted on the cornea.

One should look out for the spurting of secretions when forcibly separating the lids, as they are often projected a considerable distance under such circumstances, and might reach the eye of the examiner.

Drugs

To avoid any possible harmful movement in the application of any substance to the eye, or in any manipulation about the eye, it is best to stand in such a position with relation to the patient that one is not obliged to move the body, but can perform all movements with the hands alone; in other words, have the body firmly anchored. If, with a pipette, irrigating syringe, or instrument in the hand, one should stumble against the patient by tripping on his feet or on the leg of the chair, serious injury might possibly be inflicted on the eye.

In case the patient has his eyes closed, it is well to touch some indifferent part of the face first, in order to attract his attention and thus avoid any movement on his part which might prove injurious to the eye.

In considering the subject of therapeutics, only the most commonly used drugs have been mentioned. It is not so much what is to be used as what may be used in the eye, and it is considered wiser to err on the side of conservatism.

There is practically no end to the list of drugs recommended for use in eye practice. Some are of proven value, while others are still used empirically.

The structure of the eye is so delicate that strong solutions cannot be employed, and, therefore, in the successful use of antiseptic solutions it is often more the mechanical removal from

the lids and conjunctival sac of purulent discharges and accumulations than any particular virtue in the drug itself.

Lotions or Collyria

These are used copiously both in and about the eye, and are much more grateful to the patient and less likely to produce unpleasant symptoms if they be warmed before introduction into the conjunctival sac. This, in fact, applies to all substances entering the conjunctival sac, except, perhaps, salves.

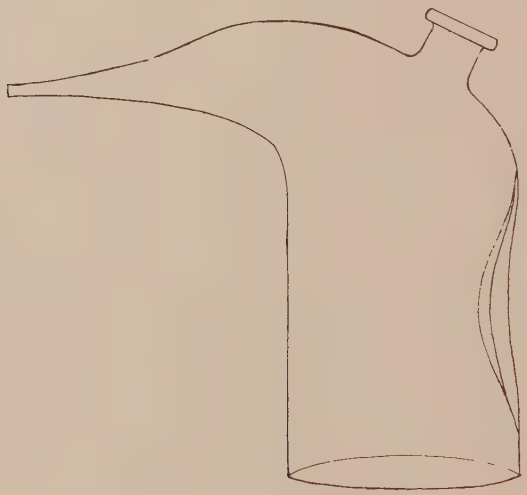

Fig. 12. Undine.

There are various means of applying collyria to the eye, as, for instance, the following: They may be allowed to flow from a specially designed flask called an *undine*. This is a glass bulb resembling, somewhat, a chemist's retort, but with a much shorter projecting tube. The flask has an opening on the side whereby the flow is controlled by placing the finger over it. An ordinary fountain syringe may be used. This, however, should not be held more than a foot above the head, owing to the danger of too great force from the stream.

A very practical means of applying solutions is with an ordinary syringe, that is, a large rubber bulb provided with a glass irrigating tube. Or the ordinary soft rubber syringe used in ear work may also be employed. In cases where any of the above are not to be had, an ordinary syphon may be used.

Aside from the above, solutions may be applied by means of gauze or cotton, squeezing them out into the conjunctival sac. This latter method is particularly practical in the treatment of burns, where the gauze or cotton may also be used to remove particles of the offending material that could not be easily

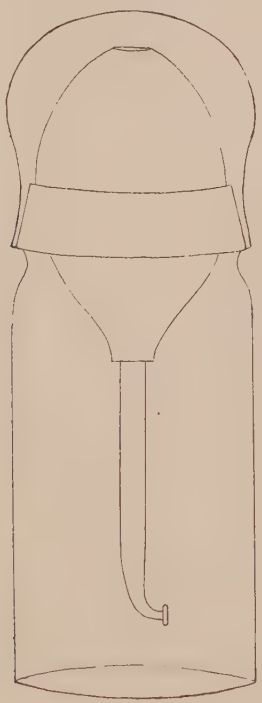

Fig. 13. Bottle with Irrigating Syringe.

washed out, as, for instance, lime. It might well be mentioned here that dry cotton or gauze should never be used in manipulations within the conjunctival sac. Even on the margins of the lids there is always the danger of introducing threads or filaments which might give rise to discomfort, or to some possible harm. Externally, it is, of course, not so important, although dry cotton should never be placed immediately next to an eye in applying a dressing.

To prepare a cotton cone or sponge for use about the eye, whether during operations or treatments, moisten a piece of cotton about the size of the palm of the hand and squeeze most of

the solution out. The moistened pledget is now placed between the palms of the hands and firmly rolled, when it will assume the form of a cone. Such a cone insures much greater accuracy of touch than when using an irregularly formed pledget of cotton, as with a cone one has a definite point with which to touch the surface desired.

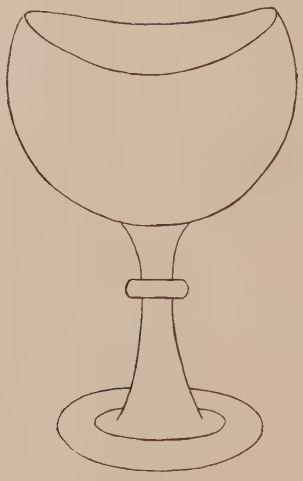

Fig. 14. Eye Cup.

There is one other means of applying solutions to the eye, although it is not used as much as formerly, at least by the profession—that is, the eye-cup. This is, as it were, a miniature tumbler, flattened in one direction, its lips being so curved as to make it fit snugly over the eye. The cup is filled about three-quarters full with the solution, the patient bends his head down and holds the cup to the eye; when it is firmly in place he raises his head again and throws it backwards; the lids are now opened and closed, thus allowing the solution to enter the conjunctival sac. The eyeball may also be moved in various directions while the lids are open, thus bringing the solution in contact with all parts of the sac. It is needless to remark that the cup should be kept scrupulously clean, and that each individual should have his own.

It is necessary to observe great care when irrigating an eye that the tip of the irrigating instrument does not come in con-

tact with the cornea, nor that any great degree of force be imparted to the stream; also that the stream be not turned directly against the eyeball. To avoid any of these objectionable points in manipulation, the irrigating tube or nozzle should be held almost parallel with the lid margin.

To irrigate the lower cul-de-sac, one stands behind the patient, whose head is thrown well back and rests against the body of the operator. The patient at the same time holds an irrigating basin, or coarse towel, firmly against the side of his neck and under his chin. (These are not shown in the illustration).

Fig. 15. Irrigating Lower Cul-de-sac.

He is now instructed to look up, the lower lid is drawn down and the sac gently washed out with the stream directed toward the inner canthus. The point of the nozzle should be just at the outer canthus, but not touching it. The quantity of solution used depends, of course, upon the amount of secretion. Instead of the irrigating basin, a large pledget of cotton or towel may answer the same purpose, depending upon the amount of irrigating solution used.

In irrigating the upper cul-de-sac and upper part of the eyeball, the procedure is the same except that the patient is instructed to look down and away from the outer canthus, while the upper lid is gently pulled well away from the eye-

ball by means of the cilia, and the stream directed from the outer canthus up into the upper cul-de-sac or the stream may be applied just along the margin of the upper lid as it is held away from the bulbus. The lids will slip if not held firmly.

Upon completing an irrigation the lids should be gently dried with absorbent cotton.

As to the character of the lotions used, these may be classed under three heads, viz.: Antiseptic, Alkaline, and Acid lotions.

Fig. 16. Irrigating Upper Cul-de-sac.

Antiseptic Solutions

Under the first heading may be mentioned such solutions as the following: *Boric acid* and *borate of sodium*, which are perhaps the most generally useful, and are the basis of almost all proprietary eye-waters. An excellent lotion is the boric lotion mentioned several times in the following pages. This is a combination of boric acid and sodium borate with a 1-10000 solution of bichloride of mercury. Such a prescription would be as follows:

℞

Acid borici	gr. xx
Sodii biboratis	ʒss
Sol. hydrarg. bichlor (1-1000)	ʒii

M. Sig. Eye-drops

The latter solution may also be used alone, although bichloride solutions have the disadvantage, when used in preparation of the field for operations, of dulling the edge of the knife or any cutting instrument.

Formalin 1-5000 is also used an an irrigating solution, although it is inclined to be irritating.

Aside from the above there may be used solutions in sterile water of sodium chloride, 1 per cent; potassium permanganate, ¼ to 1 per cent; carbolic acid, 1/10 of 1 per cent, and also plain sterile water.

Alkaline Solutions

Of Alkaline solutions, *sodium bicarbonate* (baking soda) 4 per cent, or *sodium carbonate* (washing soda) 4 per cent, are perhaps the only ones that need be mentioned. The latter is particularly used for the purpose of dissolving crusts on the lid margins, a pledget of cotton saturated with the solution being laid for a time on the lids, and the loosened crusts being thereafter wiped off. Both of these solutions are also used in free irrigation of the eye in case of burns by acids. If the patient be seen immediately after the accident, dip pieces of absorbent cotton into the solution and bathe the eyes for a few minutes, or irrigate the sac, as the case may be. Dry the lids well and avoid the open air for a time thereafter. This application may be repeated as often as required. For the quick preparation of an alkaline solution, add a teaspoonful of either of the above to a cup of water.

Acid Solutions

As to acid solutions, these are rarely used except in case of burns with alkalies, of which the most important is lime. Lime particles are very prone to lodge in either the upper or lower cul-de-sac, and particular care should be observed that these locations be free when searching for them. Acetic acid, 1 per cent to 3 per cent, is the solution ordinarily used. Vinegar, being 6 per cent acetic acid, can, therefore, be diluted one-half, and answers the purpose admirably. The method of application is as that described in the preceding section. A weak acid solution is also mildly astringent and sedative to the conjunctiva.

Eye Drops (Guttae)

Most of the remedies used in the form of drops are now prepared in the form of little wafers, or discs, thus insuring accuracy of dosage, and lessening danger of injury to the cornea. These are touched with a little wooden rod, previously moistened, to which they will readily adhere; or a cotton-tipped ap-

Fig. 17. Ophthalmic Discs.

plicator, also moistened, will answer the same purpose. They are placed in the lower cul-de-sac after everting the lower lid and having the patient look up, or may be placed directly upon the bulbus as the patient looks down. They dissolve very quickly.

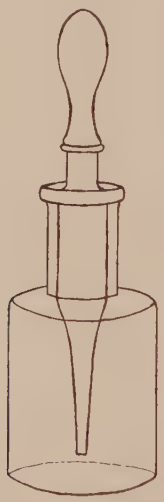

Fig. 18. Bottle and Medicine Dropper.

Drops are used in more concentrated solution than collyria, and they are much less staple in composition. They are applied by means of glass droppers or pipettes, with which everyone is familiar. Probably the most satisfactory method is to have the bottle containing the solution provided with a pipette with a ground glass body, this acting, at the same time, as a stopper for the bottle. The part of the pipette acting as the stopper

should be smeared with a little oil in order that it may not become fixed, as it is often difficult, and sometimes dangerous, to dislodge a stopper when it is glued in by the dried solution. By adopting such an arrangement the dropper is always at hand, and the danger of confusing the pipettes and contaminating them with a variety of solutions is obviated. This might be attended with considerable harm, as, for instance, using a dropper for the application of boric acid when the same dropper had been previously used for atropine. In using droppers which are not fitted to the bottles, great care should be observed that they are thoroughly cleansed—not only the glass, but the rubber as well. It is well to turn a new bulb inside out and cleanse thoroughly before using.

The bottles should all be carefully labeled, the name preferably being painted on with white paint. This does not wash off, nor is there any label to become soiled and thereby illegible. The label should always be examined before using any drops from the bottle, as the position of a bottle might easily become changed, and the wrong drop consequently instilled.

To apply drops, seize the rubber bulb of the pipette with the thumb and first finger, press and then release. In this way it is filled with the solution. The glass part of the pipette is now grasped and lifted from the bottle. If the pipette be removed by means of the bulb the probabilities are that most of the solution will be forced back into the bottle. The dropper is much better controlled if it be allowed to rest on the ends of the fingers a short distance from their tips, pressure being made by the thumb and forefinger to expel the drop. All air bubbles should be expressed so that a full drop may be formed for instillation; or the air bubbles disappear if the pipette be slightly warmed, as, for instance, with the hand. A small pledget of cotton should be held in the other hand ready for use. The patient is now instructed to look up, the lower lid is everted, and with the pipette placed in a position parallel to the lid margin, a drop is placed on the lid just inside the row of cilia. The patient is now told to look down lightly, the lower lid is released, and the excess solution which escapes from underneath the lashes is wiped off with the piece of cotton. Al-

ways wipe down and toward the temporal side, beginning on the lid itself.

If the patient insist on looking down and blinking his eyes while an attempt is being made to introduce a drop, it may be necessary to hold the lids apart with the thumb and forefinger, as was explained in speaking of refractory children.

Never point the pipette at the eye. A sudden move on the part of the patient or oneself might result in injury to the cornea. The conjunctival sac, with the lids closed, holds but one drop, although, as was mentioned before, eight or ten drops may be applied if the lower lid be everted and the patient look

Fig. 19. Instilling Drops—Lower Cul-de-sac.

either straight ahead or down; that is, provided there be not too much orbital fat.

In the application of eserin or atropin or any drug which is intended to reach the deeper structures, the drops may be applied directly to the bulbus; or over all the surface of the conjunctiva, according to the following method: The patient looks down; the upper lid is held away from the bulbus, either by pulling up on the skin, or by seizing the cilia between the thumb and forefinger. The drop is applied to the margin of the upper lid just behind the cilia. It then takes the following course: Over the upper palpebral surface of the conjunctiva, down over the globe, and then into the lower cul-de-sac. In this way the full benefit of the drop is obtained, and scarcely any of it flows

over the lid or through the puncta. This is quite important when such powerful remedies as atropin, eserin and cocain are employed over a considerable period of time, owing to the possible constitutional, or toxic, effects which may develop. The maximum local effect of the medicine is also obtained. This method may be used in the application of any drops.

All of the above assumes, of course, the coöperation of the patient. In the case of refractory children it is different, and special measures must be adopted. The recumbent position, or German method, as mentioned in the introduction to this section, is then used. The head is tilted to the right to medicate the left eye, and to the left to medicate the right eye. About ten drops are placed on the closed lids, and this forms a little

Fig. 20. Instilling Drops—Upper Cul-de-sac.

pool at the inner canthus. The lids are now held apart, or the patient opens them spontaneously, and the solution flows into the eye. This method is, of course, not feasible in the application of strong remedies, which must be instilled by single drops with forcible separation of the lids.

Following the instillation of any drops, it is always wise to cleanse the hands, as some of the medicine might otherwise reach the eye of the one making the application.

Anesthetics and Analgesics

General anesthesia is seldom used in eye practice, except perhaps for enucleation or some such major procedure, or in

the case of refractory children or unruly adults. Local anesthesia will be quite sufficient in all cases, provided one have the coöperation of the patient. Of drops, a solution of *cocain* is, of course, the anesthetic par excellence. It is applied in percentages varying from 2 to 10, but best perhaps in 4 per cent solution in combination with 1 per cent holocain. Several applications are made at intervals of several minutes, and in ten minutes sufficient anesthesia is produced to last about twice that time. There are cases on record where the conjunctiva showed immunity to the influence of cocain.

To induce profounder anesthesia, a 2 per cent solution may be injected hypodermically into the conjunctiva or lids. The use of 1-1000 adrenalin solution in combination with the above is said to produce more certain anesthesia, and at the same time controls hemorrhage.

Cocain is best freshly prepared, as it is rather unstable. A fungoid growth develops if it be kept too long. It makes a clear fluid, which is uninfluenced by light. It is sometimes slightly irritating when first introduced. Too frequent use causes softening of the cornea, which is evidenced by haziness, particularly if the eyes be kept open; it is therefore advisable to keep them closed when inducing anesthesia. It does not act so well in the presence of local inflammation. Upon its use the pupil becomes widely dilated in about twenty minutes, as does also the lid fissure; and the vision is somewhat blurred. The effect of this dilatation lasts for an hour or two. Toxic symptoms seldom develop, but when they do they usually consist of a feeling of nausea and unsteadiness, and perhaps fainting, although this latter symptom is more often a psychical manifestation. If fainting should occur, place the patient's head between his knees, and administer smelling salts or spirits of ammonia. A cup of black coffee and the open air are usually sufficient to restore the patient to normal.

Cocain is sometimes combined with morphin hydrochlorate, 3 per cent, in case of extreme pain, where the former alone is ineffective.

Holocain is used as a substitute for cocain, although the two are usually combined. A 1 per cent solution of this drug is equal to about a 2 per cent solution of cocain, being, therefore,

twice as powerful. It produces anesthesia without dilating the pupil or paralyzing accommodation. It is also somewhat antiseptic. It is a clear solution and uninfluenced by light. There should be no precipitate. Similarly to cocain, it is somewhat unstable.

Dionin is a derivative of morphin, and is used in percentages varying from 5 to 50. Five per cent and 10 per cent solutions are most commonly used. It is of benefit in deep-seated pain, useful in the absorption of corneal opacities, and assists in dilating the pupil. Depending upon the idiosyncrasy of the patient, it produces at first smarting, burning and lacrymation, or even edema of the conjunctiva, so extensive as to cause the conjunctiva to overlap the margin of the cornea. The symptoms first mentioned soon subside and give place to a sense of relief.

It is also used in powder, when an extreme effect is desired. A mere pinch is sufficient; or it may be dusted into the eye as hereinafter described.

The drops may be used three or four times daily, if required; but the powder is seldom used more than once daily, or at longer intervals. One favorite method is two drops every two minutes for ten minutes.

Argyrol is a valuable organic salt of silver, markedly antiseptic, non-irritating and somewhat anesthetic.

Chloretone, although never used to produce anesthesia, has an analgesic action.

Mydriatics and Cycloplegics

These are drugs which dilate the pupil by paralyzing the sphincter muscle of the iris, and in the case of cycloplegics produce paralysis of the ciliary muscle. They are used in cases where adhesions are binding the iris to the lens, or for the purpose of breaking these up after they have already formed. They are also used in inflammations of the iris, even where adhesions are not present, as they relieve pain and control the inflammation. Mydriatics (atropin and homatropin) are also used in determining the strength of glasses required.

The most commonly used of the mydriatics is *atropin*, in 1 per cent solution, although the actual powder may be used where an extreme effect is desired. In the latter case the eye is

cocainized, and a minute quantity of the pure atropin powder is placed in the conjunctival sac, either by placing it on the end of a little spatula or dusting it in with a camel's hair brush or cotton-tipped applicator. It is allowed to remain in the sac ten minutes, during which time the patient is to lie on the side of the affected eye and hold the lachrymal puncta closed by pressing the tips of the thumb and forefinger firmly against the inner canthi. This latter procedure of closing the lachrymal puncta may also be necessary in the use of the atropin or homatropin drops, for some individuals are very susceptible to the action of these drugs.

The use of the actual atropin powder is rather a dangerous procedure, and great caution should be observed.

A recognition of the topic symptoms and peculiar effects of atropin is also of importance. It may act as an irritant, producing redness and swelling of the lids; or eczematous eruptions may develop on the skin of the lids or in the neighborhood of the eye. Atropin catarrh may be the result of long-continued use. Symptoms of general intoxication are manifested by dryness of the throat, flushed face, fullness in the head, fever, slow and then rapid pulse, headache, delirium, coma, slow and deep respiration. Such symptoms should be particularly looked for in children. The antidote is ¼ gr. of morphin hypodermically; sweats and stimulants. Above all stop the atropin. In old people, tenesmus and retention of urine often result from the use of atropin. It must be prescribed with great care, particularly after the age of forty. In any case where there is a tendency to increased tension or the history of glaucoma its use is positively contraindicated. The effect of a single instillation lasts from ten days to two weeks, during which time dark glasses should be worn to protect the internal part of the eye from light. Dilatation takes place in a few minutes, normally.

Where atropin is not well borne, daturin or duboisin, each ¼ per cent, may be substituted; the action is quicker, but the duration is shorter.

The solution of atropin is quite stable, and it may be kept in a clear bottle. It is perhaps advisable to color it with a so-

lution of magenta red, since it is a dangerous drug and can do irreparable harm when improperly used.

Euphthalmin also acts as a mydriatic, but its effect lasts only a few hours. Dilatation takes place in about one-half hour, normally. It is best combined with cocain, of each 2 per cent. It is used chiefly for examinations and not as a remedial agent. The solution is colorless and fairly stable.

Homatropin hydrobromate 2 per cent, also best combined with cocain 2 per cent, is another drug which is not ordinarily used for therapeutic purposes, but chiefly for ophthalmic examinations, as, for instance, in the determination of glasses required. The effect lasts about thirty hours. It is a clear solution and can be kept in colorless bottles, but is best freshly prepared, as it deteriorates rapidly.

Miotics

These are drugs which contract the pupil, having, therefore, just the opposite effect from mydriatics. They are used chiefly where the intraocular tension is increased.

Eserin, ½ per cent to 1 per cent, heads the list, and is, in fact, the only one which need be mentioned. The effect lasts only a few hours. The instillation is often followed by considerable pain in the eye and brow, and it is, therefore, advisable to combine it with cocain and dionin. A conjunctivitis may be set up if its use be too prolonged.

The solution is stable, and the pink color which develops after a short time does not interfere with its efficacy, although it increases the irritating effect upon the eye.

Antiseptics and Astringents

The drugs under this head are useful in inflammatory conditions of the conjunctiva, acute or chronic, particularly in purulent ophthalmia. They are also used in a prophylactic way.

Silver nitrate is the most generally useful, and ordinarily in 2 per cent strength. Its use as a prophylactic in the newborn, according to the method of Credé, is very valuable. When stronger solutions than 2 per cent are used it is best to follow with a few drops of normal salt solution. The weaker solutions are neutralized by the salty tears.

The solution of silver is clear, and there should be no precipitate. It is stable if kept in dark bottles, but light causes it

to deteriorate. If used in strong solution it causes the tissues to be stained black (so-called Argyrosis), although the weaker solutions cause no such staining except after prolonged use. Massage with bichloride ointment, 1-5000, is said to be effective in removing this stain. The ordinary stain on the flesh is removed by rubbing well with a solution of potassium iodide.

The actual crystals of silver nitrate fused into a stick are sometimes used in extreme cases. This leaves a thick scum, or eschar, much more intense than the delicate white film which follows the use of the weaker solutions.

Silver should not be used just before retiring, as it is liable to give rise to considerable pain.

There are various proteid preparations of silver, chief among which are argyrol and protargol.

Argyrol is used in 10 per cent to 40 per cent solution. It is non-irritating, and, in fact, exerts a certain sedative influence. Argyrosis does not so often follow its prolonged use. It is a dark, almost black solution, and should be prepared fresh about every two weeks. It can be applied every few hours, or every fifteen minutes, if desired; the latter method of application constitutes the so-called argyrol bath.

Protargol is more irritating than argyrol, but less irritating than solutions of silver. It is used in 5 per cent to 25 per cent solution, and corresponds in almost every respect with argyrol except that the color of the solution is of a lighter brown.

Another antiseptic solution is the so-called X. C. Scott solution, which consists in a combination of hydrastin, boric acid and opium. It can be used every hour in severe cases, and is very effective. The prescription is as follows:

℞

Hydrast. sulph.	
Acid boracic	
Sod. boratis	āā gr. v
Tinct. op., deodor.—	fl. ʒss
Aquae dest. q. s.	fl. ʒi
M. Filter	

Boric acid in 3 per cent solution, although used chiefly as

a lotion, is also useful in the form of drops, having soothing and antiseptic properties.

The boric lotion previously mentioned as a combination of boric acid, sodium borate and bichloride of mercury 1,10000, is perhaps the most useful of the antiseptic eye-drops, and is as a rule instilled after the application of heat or cold. The solution may be colored with one or two minims of a 1 per cent solution of fluorescin or pyoktanin, in order to differentiate it.

Zinc sulphate, ¼ to 1 per cent, exerts an astringent effect when such is desired, as, for instance, in superficial injections of the conjunctiva or in follicular conjunctivitis. It is also specific (1 per cent) in angular conjunctivitis. It is a colorless solution and may be kept in clear bottles, since it is uninfluenced by light and very stable.

Lead acetate is merely mentioned to warn against its use, as in the presence of ulcers or abrasions of the cornea a deposit of lead may take place which absolutely resists all efforts to remove.

Adrenalin is a powerful astringent. One or two drops of a 1-1000 solution cause marked anemia of the conjunctiva. This is the strength of solution ordinarily used. It is often employed as an adjunct to other remedies to increase their action. Its use is contraindicated in corneal ulcers, since it interferes with the nutrition of the cornea on account of its influence on the blood vessels. It is a colorless solution, and is best kept in colored bottles, although it is very stable under any conditions.

Miscellaneous

Fluorescin, 2 per cent solution with 4 per cent sodium bicarbonate, is a solution used for diagnosing ulcers and abrasions of the cornea. One drop is instilled into the eye, and after a minute or two the sac is thoroughly irrigated with an indifferent solution. In the presence of ulcers or abrasions the surface involved is colored a beautiful green. This color very soon disappears, and the substance acts in no way deleteriously upon the eye. The solution is of a light brownish color, is very stable, and can be kept in clear bottles.

Stimulants

These substances promote absorption after the acute stage

of an inflammation has passed. They should be avoided in the presence of photophobia, lacrymation and circumcorneal injection. It is perhaps best to cocainize the eye preceding their use.

Absolute alcohol has its particular use as a direct application to herpetic lesions of the cornea.

Jequirity solution, usually 3-1000, is used in cases of trachoma for the absorption from the cornea of a vascular growth called pannus. It is painted over the conjunctival surface of the everted lids two or three times, at variable intervals depending upon the reaction, and gives rise to a marked inflammation resembling purulent ophthalmia. When the inflammatory condition subsides the opacity of the cornea is often found to be markedly improved. This drug is seldom used except in extreme cases. The solution is made as follows:

Jequirity seeds	3 parts
Cold distilled water	500 parts
Macerate for twenty-four hours, then add boiling water	500 parts
Filter when cold.	

Dionin in 10 per cent to 50 per cent, or the pure powder, is also a stimulant, and its use is generally followed by marked reaction. At times one drop of a weak solution will produce a very active result where the patient is particulary susceptible to its action. The drug has been described under analgesics, since its ultimate effect is of that nature.

Oily Solutions

There is a great variety of oily solutions of drugs, making an excellent form for application. Their absorption is much slower than that of aqueous solutions, and they are, therefore, particularly useful where a slow action is desired. They are also useful in the case of burns, and in the presence of profuse lacrymation.

Pure castor oil or pure olive oil are perhaps the best excipients. They are also used as simple lubricants.

Cocain alkaloid 2 per cent. Useful in burns of the eyeball or of the palpebral conjunctiva.

Chloretone 8 per cent. Antiseptic and anesthetic. Also useful in burns.

Eserin oil ½ per cent. Does not become red as does the aqueous solution. Used in glaucoma where the condition is chronic.

Atropin oil ½ per cent. Also for long continued use, or in case of burns where the iris is inflamed.

Mercuric iodid oil ½ per cent. Used as a dressing before operations.

Ointments

Those most commonly used can be obtained in collapsible tubes. The use of these tubes forms perhaps the best means of introducing ointments into the eye owing to the simplicity and accuracy of application. The danger of injuring the cornea by the use of the customary glass rod is also avoided.

The patient is instructed to look up, and the lower lid is drawn away from the bulbus, giving quite a roomy space into which to introduce the salve. The point of the tube is now placed on the margin of the lid at the outer canthus, pressure is made on the tube and the salve is discharged into the lower fornix. Where the salve is fairly thick and a stream is formed, an inch or two is usually sufficient. It may curl up in the lower fornix or lie as a straight line of salve.

The salve may be deposited directly upon the bulbus, if desired; in this case the patient looks down and the upper lid is held back so that the upper part of the eyeball is exposed. After the salve has been introduced the patient is instructed to look down lightly, and gentle massage is performed over the closed lids. This distributes the ointment evenly over all parts of the conjunctival sac. In some cases this massage is one of the chief features of the treatment, and will, therefore, be described at length after the other methods of introducing the ointments have been considered.

If the ointments are kept in little containers, the best method of introducing them is by means of a glass rod with one extremity flattened out. A small bit of the salve, about the size of a pea, is placed upon the flat end of the glass rod; the patient is told to look up; the lower lid is everted, and the anointed end of the rod placed horizontally in the lower cul-de-

sac. As the patient closes his lids on the rod, it is gently withdrawn from the outer canthus, at the same time pressing down with the point in the lower cul-de-sac to avoid injuring the cornea. In this way the salve is left deposited in the sac, and massage is carried out in the manner to be described. There is always the danger of injuring the cornea in such a procedure, and the method is not nearly so clean nor aseptic as when the collapsible tube is used.

Fig. 21. Massage.

Massage

Massage may be performed with either deep or superficial pressure, according to whether it is desired to massage the globe, or merely the lids. The ordinary rotary rubbing usually answers all purposes, and is carried out in the following manner: One stands behind the patient, just as in everting the upper lid, the ointment having first been introduced as described above. Massage of both eyes is assumed. The patient is instructed to look down, and the balls of the forefingers, or of the second fingers, if more convenient, are placed against the closed lids, a pledget of cotton intervening. Fairly vigorous rotatory motion is now carried out, but with very slight pressure on the eyeball; this is continued for two or three minutes.

To massage the lower lid the patient is told to look up, and the same rotatory motion is performed with the thumbs (or finger tips) resting against them. In massaging the lower lids it is best not to come too near their margins; the thumbs or fingers should be placed just over the orbital ridge and upward pressure made towards the eyeball. In this way a firmer hold is secured.

It is, of course, optional whether one stand behind the pa-

Fig. 22. Massaging Lower Lids.

tient or in front of him when performing massage, although the former position is perhaps preferable.

Another method used when standing in front of the patient is by resting the fingers on the forehead and performing the massage with the ball of the thumb. Or the cotton may be held between the thumb and first two fingers and massage performed with their tips. In this case, however, the firm support of the head is lacking.

To massage the cornea, the patient is to direct the eyes as though looking straight ahead, the lids being closed, and the massage is carried out in the ordinary way. The pledget of

cotton takes up the excess salve and the tears which are often secreted copiously.

Slight, and sometimes pronounced, reaction may follow the massage, depending upon the ointment used, or upon the susceptibility of the patient.

More or less salve is squeezed out through the lid fissure and becomes smeared over the lids themselves in such a manner as to make the massage difficult of performance unless the pledgets of cotton are used. The lids should be carefully wiped off,

Fig. 23. Corneal Masseur.

this procedure being more grateful to the patient if the cotton used be moistened in warm water.

Another form of massage is that with the glass rod, this usually being resorted to in the condition of trachoma. This rod is four or five inches in length, one end being shaped in the form of a smooth round ball of various dimensions, from that of a pea to perhaps twice that size. Particular care should be observed to see that no irregularities are present on the surface of the glass ball, as these would cause unnecessary pain and perhaps injury. With the first few applications it is best to cocain-

ize the eye, but later the procedure can very readily be carried out without any anesthesia whatever. Patients can even be taught to do it at home. Aside from the cocain, when required, a 1 to 4 per cent yellow oxide ointment may be introduced into the conjunctival sac, or it may be placed upon the bulbous extremity of the glass rod and introduced in this manner.

Let us assume that the right eye is to be the subject of treatment. Standing in front of the patient the lid is drawn away from the bulbus with the thumb and forefinger of the left hand, as described above, the patient looking down and to the left as far as possible. The bulbous extremity of the glass rod is now inserted underneath the upper lid as far toward the outer canthus as possible, avoiding contact with the eyeball by holding the lid away from it by outward pressure on the rod. The upper lid is held firmly between the glass rod and the forefinger of the left hand, which is laid horizontally upon it. The rod is now moved from side to side and the lid thus massaged between it and the finger. The position of the finger may be changed from time to time to correspond to the part of the conjunctiva which it is desired to reach; it is placed, for instance, near the lid margin when massaging the tarsal region, and high up toward the brow when massaging the upper fornix. Particular care must be constantly taken that no injury be done the cornea; and this is not likely to happen if constant pressure be exerted with the rod in a direction away from the eyeball. The rod is withdrawn through the lid fissure at the outer canthus, the patient looking down and to the left just as when it was introduced. For massaging the left eye, the procedure is, of course, the reverse.

Considerable reaction may follow, and there may also be considerable hemorrhage, but the discomfort from these is of but short duration. Cold applications will usually relieve the disagreeable symptoms. The massage may be repeated once or twice daily for weeks, if necessary.

This rod is also used for direct massage of the cornea, the eye having first been cocainized.

The following are some of the ointments used in eye practice:

Atropin 1 per cent, Cocain 2 per cent, Dionin 5 per cent, and Boric acid 3 per cent, prepared in the form of ointments either alone or in combination.

Eserin in ointment form is used in much weaker percentage, 1/20 per cent.

Suprarenalin ointment ½ per cent.

Protargol 8 per cent, Argyrol 10 per cent.

Ichthyol 1 per cent and Iodoform 5 per cent.

Mercurial preparations are: Ammoniated mercury 2 per cent, Red oxide 2 per cent, and Yellow oxide 1 to 10 per cent.

Brown citrine ointment is a rather irritating substance, but very useful. White's ointment is a combination of bichloride of mercury, sodium chloride, and diluted alcohol, in petroleum. It is dispensed in collapsible tubes and is one of the most serviceable ointments in the list. The proportions are as follows:

℞

Hydrarg. bichlor.	gr. 1-50
Sodii chloridi	gr. 1-10
Alcoholis, dil.	gtt. i
Petrolati	3i

M.

It is prescribed as bichloride ointment (Manhattan).

Potassium iodide 2 per cent.

Credé's ointment (15 per cent metallic silver) is frequently used as a copious dressing about the eye. It is a thick black ointment.

Caustics

In applying caustics to the eye the excess secretion of the conjunctiva must be soaked up before the application is made; this is done with a pledget of cotton prepared in the form of a cone, as previously described. Rather firm pressure is made with the pledget of cotton on the surface to be dried, any discharge in the conjunctival sac having first been removed by irrigation or by wiping it away. In drying the surface in this way the action of the caustic is not only limited, but its full effect is obtained because of its not being diluted by the secretions.

Silver nitrate probably heads the list of caustics, although it is not often used in the stick form. A solution of from 5 to 60 per cent is ordinarily strong enough, the former acting more as an antiseptic. It may be used once or twice daily, but should never be used immediately before retiring because of the intense pain which it frequently excites. This applies particularly to the strong solutions. Immediately following the application a bluish-white scum or eschar forms, the intensity of this depending, of course, upon the strength of the solution used. It is best not to repeat the application until this scum has disappeared. Stronger solutions than 2 per cent should be followed by normal salt irrigation.

Carbolic acid 95 per cent is used in case of indolent or progressive ulcers. The eye should first be cocainized (4 per cent solution). It is applied by means of a round toothpick, the end of which is merely moistened with the acid. There should be no drop of the acid adhering. Following the application the eye is irrigated with sterile water.

Copper sulphate, ninety grains to the ounce of glycerine, is also used. One drop of the glycerine solution is added to fifteen drops of water, and one or two drops of this solution is instilled into the eye. The strength is gradually increased to the point of toleration. Considerable reaction naturally follows, but the disagreeable symptoms soon subside. The application may be repeated daily.

Lapis divinus is a caustic stick consisting of a combination of copper, alum, and potassium nitrate. It is used in the same manner as the solid stick of silver nitrate.

Powders

Of these but two are commonly used in eye practice. The first is calomel. This is insufflated, that is, blown, into the eye in phlyctenular conjunctivitis or keratitis. It is positively contraindicated where preparations of potassium iodide or bromide are being administered internally. The insufflation causes some smarting and burning, lacrymation, and discomfort, but these are of short duration. There is but little reaction. The powder may be simply blown into the eye by means of a powder blower, an apparatus consisting of a bottle and a rubber bulb with appropriate tubes, or it may be dusted in with a camelhair

brush, or an applicator or toothpick loosely wrapped about with cotton. The powder blower is the most satisfactory method.

In dusting powder into the eye the lids are held apart with the left hand, or the patient is instructed to look up while the lower lid is everted. The applicator or brush is seized between the thumb and second finger of the right hand near the end carrying the powder, and gently tapped with the forefinger of the same hand. Sufficient powder will adhere to the cotton on the applicator or to the brush when either of these is dipped into it. The coöperation of the patient may be obtained, but as a rule the patient is a child, and it is often necessary to place it in a recumbent position and force the lids open. It isn't necessary to use an excessive amount of powder; and care should be observed that it is not spilled over the patient's face and clothing.

The other powder is iodoform (precipitated) which is applied directly to ulcers of the cornea by means of a cotton carrier wrapped with a minimum amount of cotton. There are now on the market little iodoform rods which are placed in the conjunctival sac and have the same effect as the powder, when they dissolve. Iodoform is more or less irritating.

Other Remedies—Local and Constitutional

The hypodermic needle also occupies quite an important place in the treatment of eye affections, being used both for local and constitutional effects. Solutions are frequently injected underneath the conjunctiva in the manner described below. Those most commonly used are the following:

Normal salt solution.

Bichloride solution 1-1000, plus 4 minims of 10 per cent cocain.

Cyanide of mercury solution 1-5000.

The conjunctiva is anesthetized. The point of the ordinary needle is inserted, horizontally, deep underneath the conjunctiva bulbi and somewhat away from the margin of the cornea. A few drops only are injected—from three to ten. The pain is not severe unless solutions of mercury, or strong solutions of salt (5 to 20 per cent) are used. Considerable edema follows the injection, and this may last several days. There may also

be chemosis; or a circumscribed necrosis may result. These injections are repeated every three or four days, or oftener, as the case demands.

Cocain 2 per cent is also injected hypodermically into the palpebral conjunctiva for the purpose of anesthetization preparatory to the removal of chalazia, or growths. It is injected directly into the tumor mass.

General Hypodermic Injection. Morphine, ⅛ to ½ gr., is administered in the ordinary way for the relief of pain.

Pilocarpin is used for the purpose of producing sweats, the initial amount being usually 1/12 of a grain. A great deal depends upon the manner in which these sweats are given, the following method insuring, perhaps, the best results. The baths should be given when the stomach is empty. All the clothing having been removed the patient is put to bed and wrapped up to the chin in a woolen blanket, and again covered with at least four woolen blankets. Under the latter, six quart bottles containing boiling hot water, should be placed. If used at all, pilocarpine should now be given hypodermically. The patient is also given to drink at least a pint of very hot water, very hot and weak lemonade, or very hot tea, these to be administered through a bent glass tube, while he is in the recumbent position. In a few minutes he should begin to break out in a profuse perspiration, which should continue for at least two hours, only stopping short of that time if he shows any bad symptoms. Such symptoms are those indicative of heart failure, as this drug is a cardiac depressant. A feeling of suffocation, pressure about the heart, blue lips and finger tips, call for heart stimulants and immediate cessation of the sweats. At the end of two hours he should be thoroughly dried, and the skin rubbed with alcohol. After this he is allowed to rest for another two hours, when he may go out if he wishes. Turkish baths may be substituted in case the heart will not tolerate the pilocarpin.

Strychnia Injections are usually given as a course of injections of increasing strength, extending over a period of eight or ten weeks. They are, as a rule, combined with pilocarpin sweats. The place of the injection is immaterial; some recom-

mend the temple, while others inject, as ordinarily, into the extensor surface of the arm, or into the triceps muscle. The injections may be given every other day, alternating with the pilocarpin sweats; or, in extreme cases, both may be given daily. A 1 per cent solution is used; of this five minims are injected initially, six minims at the next sitting, seven minims at the next, and so on, increasing one drop at each sitting up to the point of toleration. This point is usually thirty-three minims, with which amount the injections may be continued for some time. A little salt cellar may be used to put the drops in before drawing them up into the syringe. The same dropper, held always at the same angle, should be used each time in order that the size of the drop may be uniform. The pipette should be attached to the bottle by a rubber band placed around its neck. A record should be made on a card provided for the purpose and kept by the patient. This is to be presented each time. Upon this card is written at each injection the amount given, in order that no error may occur. The effect of the strychnin is often very pronounced, visual acuity being increased, and the general body sharing in the stimulation. Toxic symptoms must be carefully watched for. They usually develop within twenty minutes following the injection, and consist in a feeling of uneasiness, impending suffocation, twitching of various muscle groups, dizziness, a rapid pulse; and, as an extreme symptom, convulsions, which increase to an uncontrollable degree, ending finally in asphyxiation and death. To lessen the possibility of the development of these toxic symptoms, syrup of hypophosphites, a teaspoonful three times a day, is given in connection with the injections. When they do develop the strength of the dose should be reduced. In extreme cases a hypodermic of morphine is indicated.

Tuberculin. This is also used as a subcutaneous injection in the treatment of eye affections of a tubercular nature. The initial amount is .001 mg., increasing by this quantity daily until three to five mg. is injected as a dose. The amount depends of course upon the reaction produced.

Ophthalmic Reaction. Quite recently the so-called Calmette test is being used rather extensively. This consists in the

instillation into the conjunctival sac of one drop of a 1 per cent solution of dead tubercle bacilli which, in the presence of a tubercular focus in the body, will produce a reaction in the eye in the form of a conjunctivitis. This reaction is of varying degree; either a simple injection, or a more or less vigorous reaction with deposition of mucoid masses. The reaction sets in anywhere from three to twenty-four hours.

Solution of typhoid bacilli is also instilled into the eye as a means of diagnosing that condition.

Hot and Cold Applications

Heat may be employed either as moist or dry variety. In

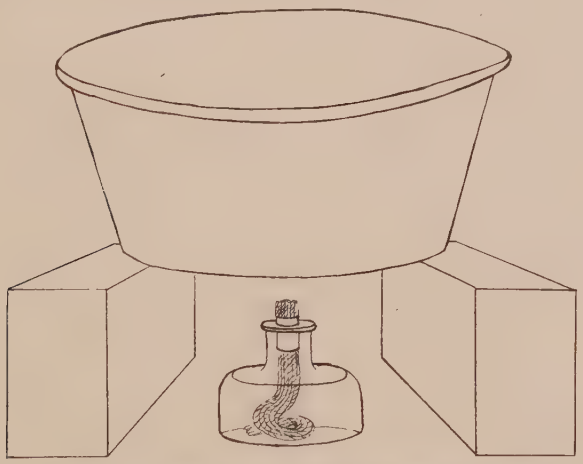

Fig. 24. Method of Keeping Water Warm.

the application of either form great care should be taken that the parts be not burned, as might be the case were the patient unconscious or in such a condition as not to appreciate the sensation of burning. The application should be made for not more than two or three days at most. It is best to interrupt at frequent intervals the application of both heat and cold in order that important symptoms be not masked.

Dry heat to the eye does not seem to be so effectual as moist heat. There are various means of applying dry heat. The use of the hot water bag may be mentioned. It should be seen that the bag does not leak, as severe burns have been known to occur through such an accident. The bag should be

only about two-thirds full of water, in order that it may adapt itself more closely to the parts. Or the application of a saucer which has been heated in the oven until too hot to touch with the bare hands, and then wrapped in a warmed piece of flannel. The irregularities of the eye should be first padded out with absorbent cotton, and a bandage applied over all to hold it in place.

Moist heat may be applied in the following manner: Have a basin of water as hot as can be borne by the finger, and kept at a uniform temperature by placing it on the stove, radiator, register, or over an alcohol lamp. The lamp can be placed under the pan, which is supported by two bricks or any suitable means, and the amount of heat regulated by elevating the pan or reducing the size of the flame. Two pieces of flannel or gauze (or, better still, a small Turkish towel or wash cloth) are all that is required in addition. One of these is now wrung out in the hot water and laid upon the eye for a few seconds, or until it begins to lose its warmth. While still in situ the second cloth should be prepared in the same manner, and as soon as the one is removed the other is substituted for it, thus maintaining a constant temperature. This can be kept up for fifteen minutes and repeated every two hours or oftener. The heat can be gradually increased. Where the skin is quite delicate it is perhaps best to anoint it with vaseline in order to prevent burning.

To *foment* the eyes with cold or hot water, the following instructions should be carried out: The patient should lean well forward over a basin half full of hot or cold water (as the case may be), holding in each hand an end of a wash cloth or small towel (folded so as to measure 4x12 inches). He lifts or "scoops" the water repeatedly up to the closed lids, forehead, and temples. This is done for a period of three minutes with cold and fifteen minutes with hot water, and is to be repeated three or four times daily, or oftener, according to the demands of the case. It should usually be followed by three or four drops of a simple eye water put into the eye with a medicine dropper. When cold water is used it should be quite cold, but never so cold as to make the hands, eyes, or head ache.

When using hot water the patient should not venture out for half an hour following its application. Neither hot nor cold water should be used for a longer time than prescribed.

Iced applications may be used in the form of gauze pads (seven or eight thicknesses) or absorbent cotton, 2½ inches in diameter. These pads are placed on a flat and smooth surface of a block of ice which should be large enough to hold at least a half dozen pads. The block of ice may rest on a piece of gauze stretched tightly over a basin and fastened underneath in order to prevent sagging. By adopting this method the block of ice does not rest in the water produced by its melting and is

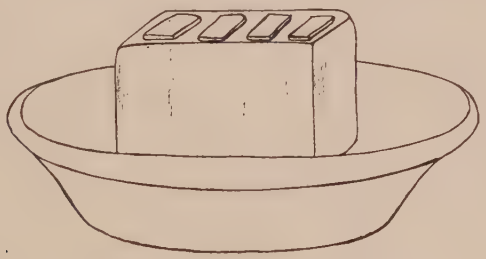

Fig. 25. Eye Pads on Ice.

therefore much longer preserved. This basin, enveloped in gauze, may also be placed in another basin in order to catch the dripping from the gauze and give it a better surface to rest upon. The excess water should be wrung out before applying the pads to the eye, as they should be moist and not wet. The water should not be allowed to run over the face because of the disagreeable chilling of the surface of the skin. The pads should be replaced frequently just as in the application of hot cloths, and there should be as little delay as possible in replacing them, in order that a constant temperature may be maintained.

The Leiter coil (described in the section on the Ear) is sometimes used for the application of cold to the eye, although its weight is objectionable, as is also the fact that the water condenses on the outside of the tubes. The same objection regarding weight applies to the ice bag.

Cold is generally employed in superficial inflammations of the eyeball and lids. It is also indicated in injuries of the

globe. It is to be avoided when the cornea is affected, and should not be applied continuously for more than a few minutes, as intense cold is quickly produced and this is very injurious to the eyes.

Hot applications are made in deep-seated inflammations of the globe, and are especially indicated in inflammations of the cornea, iris and ciliary body. Their object is to stimulate the circulation and relieve pain.

Liniments

In certain conditions accompanied by circumorbital pain relief is sometimes obtained through the application of liniments with massage. Great care should be observed that none of the liniment reaches the eye. The so-called "A. B. C." liniment is a very valuable one. This consists of equal parts of aconite, belladonna and chloroform. Belladonna liniment, which consists of equal parts of extract of belladonna, pure glycerine and pure lanolin, is also useful. There is almost an endless variety of these liniments. The pupil often dilates upon their application where atropin instillations are futile.

Ointments

Mercurial ointment is often used upon the skin around the eye, with massage. It is, however, more often used generally as the so-called "Smear Cure," which consists in the application of a drachm of the ointment five successive nights in five different places, namely, the inner aspect of the arms, the inner aspect of the thighs and the abdomen. The salve is thoroughly rubbed into the skin for at least fifteen minutes. Following the fifth application a general hot bath is taken and another successive five applications made; this is followed in turn by another hot bath, and so on until each place has received five inunctions. Following an application it is well to throw a few turns of bandage about the part, in order to prevent soiling of the clothing. Some delicate skins will not tolerate the inunctions, although this is seldom the case where a different part is used each night. This constitutes a "cure," and as many cures may be taken as the case seems to demand.

Counter-irritation

This is of questionable value, but is sometimes used in cases of keratitis, iritis, and deep-seated and chronic inflammations.

Counter-irritants are applied to the temporal or mastoid region in the form of blisters, usually produced by cantharides plasters. If for the purpose of relieving pain the raw surface is dressed with an ointment of cocain and morphin, each 2 per cent; if for continued counter-irritation an irritant dressing is applied.

Local Abstraction of Blood

This procedure often assists greatly in the reduction of most acute, deep-seated inflammations of the eye, such as iritis, glaucoma, etc. Probably the best method of accomplishing the abstraction of the blood is by means of the leech, either natural or artificial. The latter is, however, preferable, as it is more certain in action, more agreeable to the patient, and better adapted to regulating the amount of blood abstracted.

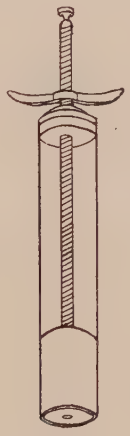

Fig. 26. Artificial Leech.

The artificial leech consists of a glass cylinder with a piston. On the latter is a thumb-screw, by means of which the dasher can be raised and lowered. The skin of the temple, having first been sterilized, is scarified about an inch from the margin of the orbit. The dasher of the piston is screwed down so that it is almost flush with the mouth of the cylinder. The end of the cylinder is now applied over the wound, and the air in it exhausted by turning the thumb-screw and thus raising the piston. The resulting vacuum becomes filled with blood after a little while. At least half an ounce should be withdrawn at

one sitting. It is scarcely necessary to state that aseptic precautions should always be rigidly observed.

The natural leech is a smooth, soft, slippery, spindle-shaped worm made up of segments, the body tapering off at each end; here the suckers are located. When it attaches itself by either end, or both at the same time, the attached end assumes a disc shape. The slightly rounded dorsal surface of the leech is of an olive-green or greenish-black color, while the ventral surface, or belly, is of a lighter yellowish-green color and somewhat flattened. It will usually attach itself spontaneously if brought in contact with the skin, but it is often necessary to encourage

Fig. 27. Natural Leech.

it by a drop of milk or by scarification, as mentioned above. Upon becoming attached it begins a sort of peristaltic movement by which it gradually sucks itself full, assuming a cylindrical form. It finally drops off of its own accord. It is then placed in normal salt solution, and will either disgorge its contents or die. The quantity of blood abstracted depends, of course, on the size of the worm, but ordinarily it is from one to two drachms. There may be some after-bleeding, which, in bleeders, is often difficult to control. The worm should be absolutely fresh and clean, rendered so by washing in cold sterile water preceding its application. It should be removed from the container with rubber gloves protecting the hands, in order to avoid its attaching itself to the one applying it. It contracts vigorously when taken hold of and assumes the form of an egg. If placed in cold water it will move about restlessly. If a leech does not exhibit such response to stimulus, but appears sluggish and inactive, it is not fit for use, and the probabilities are that it cannot be induced to take hold. One meal in six months is

usually sufficient for the ordinary leech. Just before its application it is well to place it in a basin of ice water in order to insure its activity.

The field is sterilized, and the side of the head upon which the application is to be made is covered with a large piece of gauze, protecting particularly the eyes, nose and ear on the corresponding side. The point of application is exposed by a hole about an inch in diameter cut in the gauze. The leech is applied at a point about an inch away from the outer canthus and in line with the lid fissure, although this varies according to the pleasure of the worm. It usually requires about a half hour for the ordinary leech to become gorged, and several of them may be successively applied to the same point. Pouring warm salt water over it may induce it to give up its hold in case it is desired to discontinue its action, but any attempt under any circumstances will probably result in extreme pain to the patient. Leeches are kept in an earthen or glass jar, the bottom of which is covered with clay, earth or moss, preferably clay. This should be kept moist by covering it with several inches of water. A gauze cover should be placed over the jar in order to prevent the worms from crawling out.

Electricity

Electricity, besides being used for the purpose of cauterization, is also used about the eye for its sedative action, as in supraorbital neuralgia, as well as in affections of the extra-ocular muscles and muscles of the lids. It is also used for its stimulating action, and has been found of value in hysterical affections. The constant, i. e., the *galvanic current,* is the one chiefly used, and its application should be as free from distinct interruptions as possible. If the current be gradually increased more can be borne than when the full strength is applied at the beginning. Applications to the eye and ear especially should be gradually increased and decreased. When a soothing effect is desired the positive pole is applied to the neck and the negative pole to the forehead. If the pole on the neck should produce much burning its position should be changed. About three milliamperes are ordinarily employed, and the sitting is of about five minutes' duration. It is per-

haps more agreeable to the patient if the electrodes be wrapped about with absorbent cotton and moistened with warm water. The cotton is wound about the electrode by placing a moderately large piece over the disc which is then enveloped in it, the loose ends of the cotton being twisted around the handle close up to the disc as one would twist the paper wrapped around the neck of a bottle. The excess water should be squeezed out. One sits beside the patient, he holding the posi-

Fig. 28. Galvanism—Showing Wall Plate, Positive and Negative Poles in Position.

tive pole to the nape of the neck. The head is supported by the left hand, and massage is performed with the negative electrode, which is held in the right hand. A few strokes are made across the forehead, the rheostat being watched to see that the strength does not exceed the desired amount. Some slight pricking may be complained of, and this is to be expected. The lids are now massaged, the electrode being moved with a sliding and rotatory motion from the inner angle of the eye toward the temporal region and back again to the inner angle by ro-

tating it with its margin in contact with the skin. This is done in order that the current may not be interrupted. By this rotatory motion all parts can be thoroughly massaged without once breaking the contact with the skin. Slight pressure is constantly maintained. The patient will probably complain of a metallic taste in the mouth, and perhaps also of flashes of light, both of which are usual but of no significance. He may also become dizzy, which is an indication for discontinuing the application. If marked pain be experienced when the application is made to the points of exit of the supraorbital nerves, these points should be avoided as much as possible.

Galvano-Cautery. This finds quite an important place in eye therapeutics, being used for the destruction of growths about the eyes, vascular and otherwise, as well as for the cauterization of ulcers. In the latter case it is well to stain the floor of the ulcer with fluorescin, 2 per cent, in order that no greater area than necessary be cauterized. The eye is, of course, first cocainized. Several applications of the cautery may be necessary.

Electrolysis. This is also performed with the galvanic current as a means of destroying eye lashes or growths about the eye. In the former case the positive pole is placed on the cheek and the negative pole, in the form of a needle, is plunged deep into the hair follicle. The current is closed for sixty seconds. There is slight seething and bubbling about the bases of the hair, and in a moment the hair may be drawn out with ease. The procedure is somewhat painful, and may require a general anesthetic where one is not able to obtain the coöperation of the patient. Local anesthesia may be produced by cocain applied superficially or by means of the hypodermic needle. Corneal opacities are also treated by this means, but for the method used reference must be made to special text-books on the subject.

Faradic Electricity. This is seldom used in eye practice.

Electric Massage. This is sometimes used in eye affections for the purpose of stimulating nutrition. Special apparatuses are devised for this as well as for the so-called sinusoidal cur-

rent, a constant current of a wavy nature, which is used in affections of the optic nerve.

Electro Magnet. This has come into almost universal use

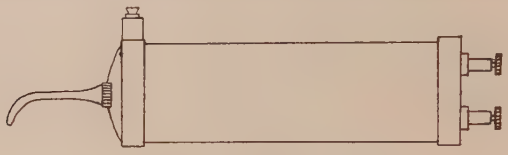

Fig. 29. Hand Magnet.

for the purpose of extracting iron and steel particles from the eye, whether located externally or within the globe. A specially

Fig. 30. Diagnostic Lamp.

devised hand magnet, that of Hirschberg, is introduced directly into the eye. In the use of the giant magnet of Haab, the patient is brought up slowly to the point of the magnet until the eye almost touches it, and the foreign body is drawn to the

surface and there extracted under aseptic precautions. Considerable pain is usually experienced when the particle begins to move. When coming into the same room with a magnet in operation, it is necessary to leave watches outside because of the injurious affect of the magnet upon them.

Electricity has still another use in eye practice, and that is in the form of a diagnostic lamp. This consists in a very minute electric light placed in the end of a handle somewhat resembling a fountain pen. The lamp is not visible except through the opening in the end of the handle. The room should be totally dark when using this lamp. It may be attached either to a battery or to the ordinary current with the rheostat intervening.

General Drugs

Those used in ophthalmic practice are the same as in general practice. They are used to meet general indications and thereby indirectly influence the eye.

Nasal Applications

These are called Collunaria, and are best used in the form of sprays. The ordinary antiseptic solutions are employed and are for the purpose of cleansing the nose preparatory to operations upon the eye, or where an eye affection is dependent upon an infection originating in the nasal cavity. The point of the spray should be directed horizontally and not straight up

CHAPTER V.

MINOR OPERATIONS AND PREPARATIONS THEREFOR. AFTER-TREATMENT.

General Introduction

There are a number of points regarding eye operations in general which it is important to know in order to secure a successful procedure and as favorable an outcome as possible.

These are, concerning the preparation of the patient for operation; what is going to be done; what means are to be employed in doing it; what bandage is required, if any, and what dressings; the general after-treatment; and something concerning the course of the diseases and the complications that may arise.

Preparation of the Patient

First, as to the preparation of the patient upon entering a hospital, and as to the time of admission. Regarding the latter point, this will of course depend upon whether the patient is to undergo a major or a minor operation, or whether he has been admitted simply for the treatment of some eye condition. Only in the case of major operations is it necessary that the patient enter the hospital the day preceding the operation; and in this case it also depends upon whether he is to receive a general anesthetic or merely a local one. In case of a general anesthetic it is, of course, necessary that the ordinary precautions be taken as to ascertaining the condition of the lungs, heart, kidneys and stomach. Operations under local anesthesia require no special preparation in this latter respect, but it is perhaps wiser to prepare the field on the evening preceding the day of the operation, and again on the day of the operation; the second dressing to be left in situ until removed by the surgeon.

Preparation of the field may be elaborate or simple, according to the nature of the operation. In the more delicate major operations, such as where the bulbus is to be opened, unusual precautions should be taken in order to avoid any possible in-

fection of the wound. This preparation consists in the following: Shave the eyebrows; clip the lashes; and, if whiskers are worn, these should also be shaved off. The head should be thoroughly shampooed. The field around the eye should be prepared as follows: Lukewarm water and green soap well rubbed in with a sponge of gauze or absorbent cotton; warm sterile water to rinse off the soap suds. The skin sponged off with alcohol, and then with bichloride solution 1-5000. Care should be taken that none of the irritating solutions reach the conjunctival sac, and this may be prevented by having the patient keep the lids tightly closed. Especial attention must be paid to the lid margins, as these are a favorite location for the lodgment of micro-organisms. The conjunctival sac is now irrigated with a warm saturated solution of boric acid, and a pad and roller bandage applied. Some prefer the application of a moist bichloride (1-5000) dressing. The patient is put to bed, there to remain until the operation.

In operations about the bulbus, where this is not opened, such as in muscle operations, no special preparation is required outside of ordinary cleansing of the field about the eye, and irrigation of the conjunctival sac with boric acid solution. The patient is not required to go to bed. However, in cases involving the eyebrow, as, for instance, in one of the operations for ptosis, this should be shaved off.

In operations about the lids the ordinary surgical cleansing of the field is sufficient. A protective bandage should be applied which remains in place until the operation, and the patient may be up and about.

Attention should be paid to sores on the face, or running ears, to see that these are properly treated or protected during the time when infection is likely to take place. In fact, anything that could in any way interfere with an uninterrupted recovery must receive proper attention. In cases where there is a discharge from the nose it is often advisable and sometimes necessary to irrigate the nose every three or four hours with warm boric acid solution from the time of entering the hospital until just before the operation—care being taken not to soil the dressing of the eye. The patient is, of course, not disturbed during the sleeping hours for this irrigation.

Instruction of Patients. In view of the fact that some patients are unable to control the motions of their eyes, either through their not being accustomed to doing this, or as a result of the fear and excitement attending the operation, it is often necessary to drill them in these muscular acts. This is in order that they may not embarrass the surgeon at some critical point in the operation when it is found necessary to move the eyeball voluntarily in a certain direction. Looking down is particularly difficult for some people, which fact will be brought forcibly to notice in vain attempts to evert the upper lid in the ordinary routine of eye treatment. A little practice in this will often have a successful result, although some cases are absolutely hopeless. He should also be taught to close the eyes tightly, which is often quite difficult for some patients—they insist upon squeezing the lids shut, and this may be disastrous in some conditions where pressure is absolutely contraindicated. As regards coughing, sneezing, and such acts as are accompanied by a great amount of straining, these can be controlled in great measure. Coughing can often be prevented by holding the breath, or by taking exceedingly slow, deep breaths through the nose. The quick current of air against the vocal cords often produces a cough which could otherwise be avoided. Sneezing, as is well known, can be controlled almost certainly by pressure against the upper lip just at the base of the nasal septum, or by pressure on the roof of the mouth at the position of the incisor foramen. The patient should also be taught to take deep breaths and to relax the body musculature. Often in an effort to lie perfectly still during an operation the patient will hold his breath and strain his entire body so that he is practically stiff. This results not only in trembling in old people, or those in a weakened physical condition, but also in straining the musculature of the eye much to the disadvantage of both operator and patient. If the mouth be held open, slow, deep breaths taken, and the whole body relaxed, it will be much more favorable to the success of the operation.

Don't talk to the patient about the operation any more than is absolutely necessary, if at all; or, if it does become necessary, let everything that is said be of such nature as to encourage him rather than alarm him as to the ultimate outcome.

It is best to avoid all discussion concerning the operation, except that necessary to the patient's instruction regarding his part in making it a success. In cases where the patient is to be confined to his bed for a period of several days and to rise under no circumstances, it might be well to allow him to make use of the bed-pan in order that he may become accustomed to it, and thus avoid undue straining after the operation has been performed.

Position

In minor operations the upright position is usually satisfactory, although there is no contraindication to the recumbent position. In such minor procedures, for instance, as epilation, passing of the lacrymal probe, slitting the canaliculi, removal of foreign bodies, incision of hordeola, chalazia, and lid abgeneral which it is important to know in order to insure a successful procedure and as favorable an outcome as possible.
scesses, the upright position is most satisfactory. It is best to have the patient seated on a straight chair, the back of which reaches only to his shoulders. The head is supported by being rested against the body of the operator. In this position it is well steadied and much better controlled than when the patient attempts to support it himself by muscular effort. He is also less likely to see every move that the operator makes, which is an advantage when dealing with nervous patients. In case the nurse is to hold the head when assisting at minor operations, it rests against her body in the same way, but her hands are placed the one on the forehead and the other on the chin, or on either side of the head over the ears. All other operations than those above mentioned are best performed with the patient in the recumbent position.

The ordinary operating table is used, and the usual preparation of the table carried out. In cases where considerable hemorrhage is expected, or where copious irrigation is to be performed, it is well to have a Kelley pad or something similar placed underneath the head. A fresh gown should also be at hand to replace the soiled one before the patient is put to bed. Some surgeons favor a sand cushion or pillow placed under the neck, while others consider this more a detriment to freedom of access to the field of operation than an advantage.

To support the head during an operation in the recumbent position, have the assistant stand at the head of the table and lay his hands flat on either side of the patient's face and over the ears with the thumbs straight up. With this position of the hands the patient cannot move his head to the side nor can he raise it up. Steadiness of the head during delicate operations such as those on the eye, is a very important factor and means much to the operator and to the patient. The elbows can be rested on the table, and the head of the assistant should be kept out of the way as much as possible. After the operation the patient is transferred to the ward cart, or allowed to arise from the table and walk to the ward himself, provided both eyes are not bandaged. In the latter case he must, of course, have assistance. In many foreign clinics the patients are allowed to walk from the operating table to bed regardless of the operation performed. It is, however, considered wisest in case of major operations to transfer the patient to his bed by means of the ward cart, and to use all possible precautions in transferring him from the cart to his bed. While the walking method may not be followed by serious consequences once in a thousand times, that once might be sufficient to destroy the sight of an eye, and that is quite sufficient to condemn the practice.

Anesthesia

Anesthesia may be either general or local. General anesthesia is indicated chiefly in children and nervous adults, and in those cases where it is difficult to produce sufficient anesthesia by local means. For local anesthesia, a 1 per cent solution of holocain combined with the usual 4 per cent cocain enhances its effect. Three or four applications of the drops to the conjunctival sac, several minutes apart, will usually produce as much anesthesia as desired. The effect lasts about twenty minutes.

Asepsis

Asepsis should be observed as in other operations. It is even more important than in any other region of the body, for infection is almost invariably fatal to sight when occurring after major operations on the eye. The subject of asepsis is so fully treated of in all general works that it is unnecessary to elaborate on it here. It is only necessary to emphasize the importance of the most rigid asepsis in eye operations, either in

the preparation of the patient, during the operation, in the after-treatment, or in the dressing of recent operative wounds. All blunt instruments may be boiled for fifteen minutes as ordinarily, but the more delicate cutting instruments used in eye operations are seriously injured by this procedure and must therefore be sterilized in other ways. Probably the best method is to let them lie for awhile, say for ten or fifteen minutes, in pure carbolic acid, or in a solution of carbolic acid (90) and glycerine (10). When they are removed from this solution they are placed in a special operating tray with parallel ridges on the bottom, and there allowed to remain until called for by the surgeon. The solution of carbolic acid adhering to the instruments forms, with the water in the tray, a solution of about 1 per cent or 2 per cent, which acts further in sterilizing the instruments. When the operation is finished they should be thoroughly washed in hot water—as hot as possible—as this insures their more speedy and thorough drying. They are then carefully dried, no particle of moisture being allowed to remain on the instrument. A speck of rust on ordinary instruments might be of no significance, whereas, in case of eye instruments, it might interfere seriously with their efficiency. In laying down an eye-knife, or any delicate cutting instrument, it is always safest to put the handle down first and then the cutting end, otherwise the delicate point or cutting edge might be injured. Particular care should be used in drying forceps. The edge of a towel should be passed up between the blades as far as it will go, thus reaching a part otherwise inaccessible.

For the *illumination* of the operating room there is, of course, no light equal to natural daylight, but where this is not to be obtained in sufficient amount, the ordinary electric light brought quite near to the field of operation in such a way as to throw no disturbing shadow, or be in the way of the surgeon, is perhaps the best substitute. There are various arrangements for increasing the intensity of this light by means of magnifying or condensing lenses. Focal illumination, such as has already been described, is also useful, and often quite essential.

Minor Operations

In the following group of cases no special dressings are required, and the upright position is usually maintained, unless perhaps the patient is too weak to occupy this position, or

there is fear of an attack of fainting. In the latter case serious damage might be done.

Epilation

Perhaps one of the simplest operations about the eyes, aside from the removal of insignificant foreign bodies, is the procedure called epilation, or the removal of hairs from the lid margins. The symptoms indicating the presence of these ingrowing hairs are a scratching, foreign-body sensation, and injection of the eyeball. Unless the original inflammation be too severe the patient can usually locate the offending cilium or cilia by the sensation produced. Focal illumination is, as a rule, necessary, and it is usually the fine, white, stiff cilia in the

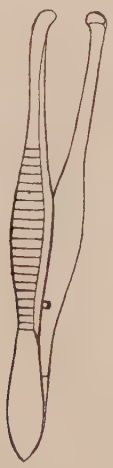

Fig. 31. Epilation Forceps.

corners of the eye which produce the most discomfort and irritation. These cannot ordinarly be seen without some form of intense illumination.

The cilia are removed one at a time, which renders the procedure nearly painless. Seize the cilium at its base with a forceps especially adapted to this purpose, and simply draw it out. The lids should be drawn away from the bulbus, as the cilia are usually in contact with it. The hairs recur with annoying persistency, and it is sometimes necessary to perform some operation for their permanent removal. In case of single offending cilia, electrolysis is often resorted to.

Foreign Bodies

The custom of introducing into the eye any kind of a foreign body for the removal of one already present, as is often practised by the laity, is pernicious and dangerous. For the removal of a foreign body the simplest method should be resorted to first. It is situated either on the cornea or on the conjunctiva, and in the latter case most commonly in the place of predilection; that is, the upper tarsal sulcus. This is a little groove along the inner surface of the upper lid about a milli-

Fig. 32. Spud.

meter away from the lid margin and running parallel to it. It is often quite sufficient to gently wipe off the foreign body with a pledget of moist absorbent cotton, a moistened camelhair brush, or a toothpick or cotton carrier well protected by cotton twisted around the point. Unless one is able to remove a foreign body from the cornea by merely touching it with the moistened sponge, it is best to leave its removal to the oculist. Should it, however, become absolutely necessary to remove it with an instrument, the so-called "spud" is the one best adapted to this purpose. This is a delicate instrument resembling a

flattened probe. Some of them are grooved, although the simple flat point answers all purposes admirably. First cocainize the eyes as directed under the subject of local anesthesia, stand behind the patient, separate the lids with the thumb and forefinger of the left hand, instruct the patient to look in such a direction that the instrument can be approached to the eyes in a horizontal position, and gently lift the foreign body from the surface.

Never point an instrument directly toward the eye even in the most insignificant operations. A sudden move on the part of either the patient or the operator might result in perforation of the cornea. Always use the instrument, dropper, etc., horizontally, and have it under perfect control.

If the cornea has not been much abraded no bandage is required, but if any considerable abrasion is present it is best to protect the eye for at least twenty-four hours. There are usually no after-symptoms except a feeling of discomfort, and perhaps a feeling as though the foreign body were still present for an hour or two after the effect of the anesthetic has worn off. The slight injection may persist for a day. For symptoms of mischief, such as infection of the wound, ulcer, etc., these have been considered elsewhere under the head of *Danger Signals.*

Dilatation of the Lachrymal Puncta

This usually precedes irrigation of the lachrymal sac. There is an instrument made especially for the purpose, which is graduated out to a fine point. This point is first introduced into the lachrymal punctum in a downward direction, the lid being stretched out and away from the bulbus; the instrument is then turned to a horizontal position with the point still in situ, and gently pushed toward the nose along the lachrymal canal. The depth of its introduction depends upon the amount of dilatation desired. After having been held in place for a short time the opening to the canal will remain more or less patulous when the dilator is removed. A drop or two of cocain (4 per cent) will considerably lessen the amount of pain produced.

Syringing the Lachrymal Sac

The contents of the sac should be first gently and thoroughly squeezed out. The punctum having first been sufficiently

dilated to admit the nozzle of the lachrymal syringe, the solution in the syringe is gently injected into the sac through the canal. The head should be inclined a little forward, as otherwise the fluid may run back into the throat and cause disagreeable retching and coughing. It is also well to hold a pledget of absorbent cotton at the nostrils to catch the fluid as it runs from the nose. No undue force must be used. There are various syringes devised for this little operation,

Fig. 33. Lachrymal Dilator.

but after all a simple rubber bulb armed with a delicate silver tip is very practical, and has the additional advantage of containing sufficient of the solution to be used to relieve one of the necessity of making frequent introductions of the point.

The solutions used for this purpose are either simple sterile water, colored, perhaps, with a drop or two of argyrol in order to be certain that the fluid has gone through, or, if some medication is desired, a solution of boric acid 3 per cent, or a 1 per cent solution of zinc sulphate. The solutions should be used warm, as should all solutions or drops employed in the eye. It is much more pleasant to the patient, and, besides, cold

sometimes sets up considerable irritation. Should it be desirable to flush the nasal duct direct, the syringe must be introduced as in passing the lachrymal probe. This is seldom done.

Slitting the Canaliculus

While probing of the canaliculus is sometimes done without previous slitting, this usually precedes such manipulation and will therefore be described first.

Fig. 34. Lachrymal Syringe.

The lower canaliculus is the one usually selected. Anesthesia is produced by the use of cocain drops in the conjunctival sac, these flowing in part into the canaliculus, depending, of course, upon the amount of occlusion of the passage. A knife especially adapted to this purpose is used. The canaliculus is slit along its entire length, leaving a gaping wound at the inner end of the lower lid margin, which is plainly seen when the lid is drawn away from the eyeball. No dressing is required, but the lips of the wound should be opened daily with a probe in order to prevent reapposition.

Passing the Lachrymal Probe

Anesthesia is to be produced locally, depending quite entirely upon the sensitiveness of the patient. Some require no anesthesia at all. The probe may be anointed with cocainized vaseline (2 per cent) to facilitate its passage, but

this is rarely necessary. The round end probes are preferable to those with square ends, as the latter may inflict considerable damage upon the delicate mucous membrane lining the sac and ducts. There are all varieties of these probes. Williams' is perhaps the most satisfactory, although the original Bowman probes, with flat ends, have been used successfully for years. Probes are numbered according to the size of the tip, as No. 1, No. 2, and so on, up to No. 10 and higher. The size is indicated

Fig. 35. Lachrymal Knife.

by a number on the central flat piece. (See Fig. 6.)

As lachrymal probes are frequently passed in the ordinary routine of eye treatment, and patients are often instructed to perform the little operation themselves, this procedure will be described a little more in detail than some of the others less commonly resorted to. And, first, as to passing the probe in those cases where the canaliculus has not been slit. Having expressed the contents of the sac, provided there be any secretion, the

lower punctum is next dilated in the manner described above. Taking a No. 2 probe as an initial size, the lower lid is pulled outward, so that it is put on the stretch, and the point of the probe introduced into the dilated punctum and passed straight down until resistance is met; that is, a millimeter or two. The probe is then lowered until it occupies a position corresponding to the direction of the canaliculus through which it is to pass —that is, to a horizontal position. The point is now very gently pushed toward the nose for a distance of about a centimeter, or until the resistance of the bony wall is felt, withdrawing

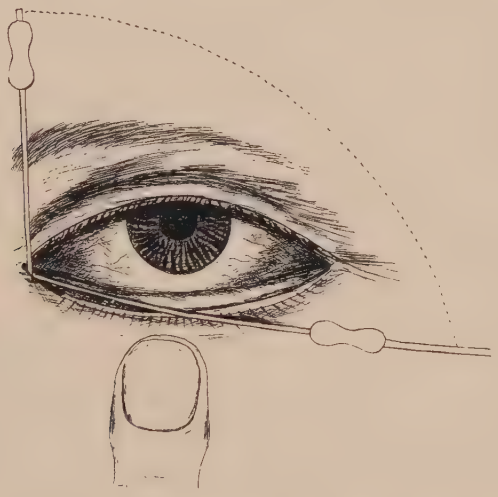

Fig. 36. Introducing Lachrymal Probe.

slightly at times in order to avoid the little folds of mucous membrane with which the probe comes in contact. Until this time the lid margin is kept on the stretch, but it is now released. The probe, being still retained in position against the bony wall, which acts as a fulcrum, and the concavity of its curve being directed outward, is now raised in such a manner that its free end is made to sweep around until the probe occupies an almost vertical position slightly beyond the median line, and rests against the brow. The point is now pressed downward, outward, and slightly backward, and is felt to pass into the nasal duct; it is pushed on down until the flat disc of

the probe is just about even with the eyebrow, or until the probe is felt to be well in the duct. It should remain in this position for from fifteen to sixty minutes, according to the time deemed necessary by the attending surgeon. Undue force should not be used. One should feel his way, and be careful about making false passages; this is most likely to occur in the use of small probes. The probe should be withdrawn slowly, first upward and then in a more horizontal direction. The operation is not so formidable as might be imagined from the description, and patients can be instructed to do it themselves in five or six lessons. It should always be kept in mind, however, that serious damage can be inflicted by unskilful manipulation. In cases where the canaliculus has been slit, it is, of course, not necessary to dilate, and much larger probes can be used; a No. 7 or No. 8 can usually be passed with little difficulty.

Many difficulties may be met, and also many accidents and mistakes. The transient edema and redness following first probings after dilation are of no particular consequence. If the skin accompany the movements of the probe it indicates that the point of the probe is not making proper headway, and it should be withdrawn slightly and another trial made. A very difficult place in the passage is the orifice of the nasal duct, and great caution should be used in passing this point.

The point must slide in easily. If four or five attempts are unsuccessful, withdraw and wait fifteen or twenty minutes, or postpone all attempts until another day. The probe is usually introduced daily for a few days, and thereafter the interval lengthened even to a month or longer. The patient should be watched for evidences of fainting during the procedure, as this occasionally occurs, and may prove serious if he should fall from the chair with the probe in situ. Probing during the presence of acute inflammation is dangerous and should not be resorted to.

Major Operations

Only the technique of after-care will here be entered into.

Cataract

For the purpose of removing this lens the following instruments, illustrated in the Appendix, are required:

Lid speculum	Iris forceps
Fixation forceps	Iris scissors
Needles (paracentesis)	Cystotome
Keratome	Capsule forceps
von Graefe knife	Spatula and spoon

Lens loop.

After-treatment. The double bandage applied at the time of the operation remains in place for two days and the patient is confined to a dark room. Particular attention should be paid to the application of the bandage that it be not too tight or uncomfortable, as such a condition might occasion considerable restlessness with detriment to the eye. On the third day the sound eye may be exposed, and on the fifth day both eyes. At this time a shade may be substituted for the bandage on the operated eye, and this is worn for another five days. Then dark glasses may be prescribed. If the patient is to leave the hospital it is best to have him wear one of the ordinary green protective shades in addition to the dark green glasses, for a period of at least two weeks.

The eye is usually inspected daily after the first day, utmost care being observed in removing the dressing that no pressure be made upon the bulbus. The patient should not be allowed to open his eyes until told to do so, and it is always well to watch his hands in order that he may be prevented from following his first impulse to raise one of them to his eye for the purpose of seeing if it is all right. Many eyes have been lost through not observing this precaution.

Before opening the lids all secretions should be removed, particular attention being paid to the lashes, as they are very likely to be agglutinated. No dressing is ordinarily applied after the fourth day.

Emphasis should be laid upon avoiding the use of cold solutions when dressing the eye, as their application might give rise to blepharospasm with consequent possible injury to the eye.

It is advisable for the patient to remain in bed for a few days following the operation. This conduces to rest, both mental and physical. This is of great importance in the after-treatment, and, in fact, it is well to have such rest for at least six

weeks following the operation. A bed-pan should be used for the first two or three days. Any tendency to coughing, sneezing, restlessness or insomnia, should be combatted by appropriate remedies.

The patient is often curious to see what vision he has with the operated eye, and must, therefore, be carefully watched and prevented from making any use whatever of his eyes.

On the fifth or sixth day he may be allowed to sit up for an hour or two. Thereafter he may gradually be allowed more liberty. As a rule the patient may be discharged the second or third week following the operation, but should be advised not to make any very extensive trip for several weeks thereafter. Glasses are usually prescribed six weeks after the operation, but it is best to use the eyes very cautiously for at least six months.

Complications. Various complications may arise during the post-operative period. These may be classed under the head of subjective and objective symptoms. Those of a subjective nature will be considered first, as they are usually voluntarily mentioned by the patient, who is naturally intensely interested in every little detail of his case. Many of the symptoms may be exaggerated, but others are of great importance.

Subjective. The first subjective symptom to be complained of by the patient will be pain. Following the operation there is usually more or less pain, burning, and smarting, for about six hours, and this is entirely normal. A sensation of swelling or flowing is often complained of, but has no particular significance. However, if the pain continue for more than twenty-four hours, or if there be sudden attacks of severe pain lasting a half hour to an hour and a half, it is usually an indication of mischief.

Some discomfort and even pain may result from agglutination of the eyelashes, or from the condition of spasmodic entropion, which frequently occurs in old people. If it be so annoying as to interfere with the patient's rest or peace of mind, the bandage should be changed, or, if necessary, a shade substituted for it. Painting the lower lid with collodion over a little wisp of cotton is also of advantage in drawing the lid away from the bulbus. The patient should be informed that the eye

may be sensitive for two or three weeks following the operation.

Temperature rarely develops unless in case of infection, and then not constantly.

Objective. There is always more or less injection following the operation, but this usually subsides in a few days. The spongy or gelatinous exudate which gives a turbid appearance to the aqueous in the anterior chamber is gradualllly absorbed, and is no more to be seen at the end of a week. There is also frequently present a small quantity of blood in the anterior chamber. This is likewise absorbed in the course of a few days. Hemorrhage may take place into the anterior chamber as a result of straining, sneezing, coughing, vigorous blowing of the nose, etc., or as a result of a blow on the eye from the hand, or from stumbling against some object of furniture. In such cases as the latter, however, the condition is usually more serious than mere hemorrhage into the anterior chamber, for, as a rule, the wound has opened, the iris prolapsed, and not infrequently the vitreous escapes with consequent loss of the eye. Patients must be particularly warned against any such accident, and must be made to realize the importance of lying quietly in bed and avoiding as much as possible all physical effort.

There is also the so-called expulsive hemorrhage in which the eye seems to open spontaneously, with prolapse of the iris and accompanying profuse bleeding.

Filtration chemosis is a glassy edema of the conjunctiva, usually on one side and in the lower part of the conjunctiva. Its position depends upon the position of the patient. It is not an alarming symptom, and soon disappears.

Herpes of the cornea manifests itself by sudden pain, slight circumcorneal injection, lacrymation and photophobia. On the cornea are seen a number of small vesicles which disappear in from six to twenty-four hours. Relapses may be expected every few days. The prognosis is usually good.

Iritis usually develops, if at all, four or five days after the operation, although its appearance may be delayed until the second week. It is characterized by pain (worse at night), swelling of the lids, lacrymation, photophobia, dullness of the

iris, and circumcorneal injection. The course may extend over a period of several weeks.

Suppuration of the cornea takes place occasionally, and may be partial or total. In partial suppuration the pain usually starts in the night. There are at first hot tears. On the next day the dressing is moist and more or less impregnated with pus. The edges of the lids are agglutinated and swollen, the conjunctiva is red and edematous, and the cornea dull. The edges of the wound show a whitish infiltration. The symptoms may diminish in a day or two and the wound clear up; or the condition may progress to a more serious degree. The cornea becomes more opaque, the anterior chamber turbid, and symptoms of iritis develop. Such symptoms may continue for a week or two and then abate. In total suppuration the whole cornea may be destroyed owing to the development of ring abscess, the internal structures of the eye being also usually involved, and the eye being lost through the occurrence of panophthalmitis. In this condition the whole eye presents an intense injection, with swollen lids, and pus protruding through the lid fissure or even running down the cheek. There is usually no danger for the other eye in these cases.

Other Major Operations

These will be considered only in the most general way, and more in the nature of an outline as regards indications, instruments, after-treatment, and complications. The instruments mentioned are those which would be required in any operation upon the part under consideration, those ordinarily used being illustrated in the Appendix:

Lids

Indications.

Plastics.
Entropion.
Ectropion.
Ankyloblepharon.
Ptosis.

Instruments.

Small scalpel
Fixation forceps (2)
Ring forceps
Spatula
Hemostatic forceps
Scissors (half curve)
Scissors (straight)
Needle holder
Needles and sutures
(Catgut 00 and silk.)

After-treatment.

Bandage—triangular, or roller with pressure.
Daily inspection after second day.
Stitches out—usually third or fourth day, depending upon condition of wound.
Healing usually complete in a week or ten days.

Complications.

Suppuration.
Hemorrhage.
Stitch-hole abscess.
Slipping of stitches.
Gangrene.

Conjunctiva

Indications..

Tumors (small growths),
Pterygium,
Symblepharon.
Trachoma.

Instruments.

Lid retractors, or speculum
Knife (von Graefe) thin blade
Fixation forceps (2)
Knapp roller forceps
Small currette
Scissors (½ curve, sharp and blunt)
Needle holder
Needles and sutures. (Catgut 00 and silk).

After-treatment.

Protective dressing.
Bandage—two to three days.
Daily irrigation—one to three times.
Little movement of eyes.
Stitches out—three or four days.
Symblepharon—reformation of adhesions prevented by daily use of the probe—two or three times.
Recovery—two to seven days.

Complications.

Same as for lids.

In addition—Recurrence of malignant growths.
Reformation of adhesions in symblepharon.
Marked reaction in trachoma.

Cornea

Indications.

Curetting or cauterizing ulcers.
Tattooing opacities.

Instruments.

Lid speculum
Small curette
Tattooing needles
India ink (paste)
Made with sterile water, and soft enough to be used in medicine dropper. Ink comes in form of black, brittle bars resembling vulcanized rubber. It is simply dissolved in sufficient water to make paste of desired consistency.
Fixation forceps
Platinum electrode (flat point).

After-treatment.

Protective bandage.
Antiseptic dressings for two or three days or longer.
Tattooing—first dressing not removed for from one to two days unless symptoms of mischief. Usually heals in few days.

Complications.

Ulcers may persist.
Tattooing may give rise to some reaction.
Ink may act as foreign body and injection keep up some time.

Muscles

Indications.

Faulty position of eyes—turning in or out.

Instruments.

Lid speculum
Scissors (blunt and sharp ½ curve)
Strabismus hooks (2)
Fixation forceps
Fixation forceps (Special—Prince)
Needle holder
Needles and sutures (catgut and silk).

After-treatment.

Bandage or eye free according to surgeon's wish.
Bandage usually worn day or two.
Daily irrigation of conjunctival sac with boric acid.
Stitches out three or four days.
Recovery two to seven days.

Complications.

Effusion of blood—absorbs gradually in one to several weeks.
Hemorrhage.
Suppuration.
Slipping of stitches.
Double vision.
Over-correction (eye may look more crossed for few days).

Bulbus

Indications.

Occluded pupil—iridectomy.
Foreign bodies—extraction.
Glaucoma.
Ulcers—corneal incision.

Instruments.

Lid speculum
Keratome
Graefe knife
Spatula
Fixation forceps (2)
Iris scissors
Iris forceps
Magnet.

After-treatment.

Bandage (protective).
Daily irrigation.
Lids cleansed of secretions.
Bed several days.

Dark glasses when up.
Fluid diet twenty-four hours.
Avoid exertion — coughing, sneezing, straining.
Permanent union corneal wound usually after first night.
Watch for increased tension — increased hardness of eyeball.

Complications.

Secondary glaucoma from adherence of iris.
Following needling — too rapid swelling of lens.
Non-union of wound.
Anterior chamber not restored.
Hemorrhage.
Infection — panophthalmitis.
Prolapsed iris.

Bulbus (blind eye).

Indications.

Total blindness accompanied by painful eyeball—removal of eyeball, or cutting nerves.
Injuries with total prolapse of contents—removal of eyeball entire, or scraping out contents; former is called enucleation — latter evisceration.
Panophthalmitis—evisceration or enucleation.

Instruments.

Lid speculum
Fixation forceps
Knife (special)
Strabismus hook
Volkmann's spoon
Scoop
Needle holder
Needles and silk or catgut.
Scissors (½ curve sharp point)
Scissors (¼ curve—large, strong, blunt)
Glass spheres — Mule's instrument for introduction.

After-treatment.

Aseptic dressing.
Bandage — triangular, or roller, if pressure is desired.
Bandage on three or four days.

Shade after first week.
Daily irrigation.
Bed for day or two.
Stitches out end of first week.
Recovery four to seven days.
Artificial eye three to four weeks.

Complications.

Suppuration.
Hemorrhage.
Stitches slip.
Artificial globe may work out.
Orbital difficulties.
Meningitis.
Death.

CHAPTER VI.

DRESSINGS, BANDAGES, PROTECTIVE FRAMES, EYE SHADES, DARK GLASSES, ARTIFICIAL EYES.

Dressings

The object of dressings is to protect the eye, and also to prevent the entrance of micro-organisms. In operative cases dressings must be absolutely sterile and aseptic, and this means in the strictest sense possible, otherwise the operation may have been done in vain. The hands should be put through the same process of sterilization when performing a post-operative dressing as when performing the operation itself. Everything that comes in contact with the operative field—solutions, droppers, irrigating apparatus, pads, sponges and bandages—should be thoroughly aseptic. And it might be repeated here that in using cotton about the conjunctival sac this should be moistened and wrung out, in order that no stray filaments may enter the sac and give rise to irritation. In manipulations about the lids dry cotton may be used, but it should at least be so arranged that the rough ends do not protrude where it is torn off from the roll.

The eye pad and bandage form, of course, the basis for most dressings. It is not always necessary to apply antiseptics in the shape of salves and solutions, and, in fact, wet dressings are not advisable about the eyes unless in case of inflammatory conditions where the object of them is to reduce this inflammation. In other cases the pad dries, unless frequently changed, and is, therefore, uncomfortable. Frequent changing is also not advisable, as it simply reopens the field to infection. An ordinary dry antiseptic pad is usually sufficient, and this is made in the following manner: The pad consists of two layers of sterilized gauze between which is placed a layer of sterilized cotton. This combination is now cut to a circular form to better fit the orbital hollow, and is usually about two inches in diameter. The thickness of the pad can be varied according to the depth of the orbital hollow or the wish of the surgeon,

either by adding to or taking away from the outside layers of gauze, or removing some of the cotton. No cotton should protrude from the edges of the gauze, this being obviated by introducing the cotton before the whole is cut. A stitch may be placed through the center to hold it together, but this is seldom necessary. As was said before, this pad may be medicated or not, as desired. Usually the application of some antiseptic ointment, such as White's ointment (See Chapter on Therapeutics for prescription), will suffice. This is simply smeared upon the side which is to come in contact with the eye, or it may be smeared upon the closed lids. This also has the advantage of preventing agglutination of the lids. Borated gauze is also used instead of the plain. Never, under any circumstances, should cotton be placed immediately next to the eye, any more than one would place it next to a burned surface; a pledget of gauze must positively intervene. The pad is sometimes made simply of gauze, and this is saturated with boric acid solution or a mild solution of bichloride (1-5000). A piece of gutta percha tissue is placed between the pad and the bandage—in fact a "wet dressing" is applied. This is used where there is much conjunctival discharge or purulent, decomposing secretion, and acts as a constant disinfectant. It must be repeatedly changed, in order that a collection of the secretion under the pad (after it becomes saturated) may be prevented. Either White's ointment or bichloride solution are sometimes used in the preliminary preparation for operation.

The discharge from operated eyes, is, as a rule, not excessive; there are, of course, numerous conditions where the discharge is quite copious, and in all such cases a bandage is contraindicated. This applies, for instance, in gonorrheal ophthalmia or eczematous conditions. If it should stain the dressing it is best to remove it and inspect the parts. In cases where it is not considered advisable to disturb the dressing, boric acid should be dusted over it and a fresh one applied without disturbing the original.

Change of Dressing. It is usually more comfortable to the patient if the dressing be changed daily. This may prevent him from becoming restless or irritable, which in some cases would be quite deleterious. When irrigation is to be performed

in the recumbent position the pillow should be covered with a rubber sheet, or a Kelly pad should be used. For irrigation in the upright position a sterile pus basin, or irrigating pan, will answer the purposes admirably. The dressings must be removed with great caution, particular care being taken that those immediately covering the eye be not roughly disturbed. This is especially important in lid plastics or cases of skin-grafting. As the last turn of a roller bandage is being removed, gently place the fingers upon the pad next to the eye and hold it in place until the bandage is entirely off. Avoid all undue pressure upon the eye when doing this, and preferably exert all the pressure upon the surrounding region. If the pad be tightly adherent to the lids, lashes, or surrounding parts, or to the bandage, as in the case of dried secretions, cut the bandage off on either side of the pad, saturate it and remaining bandage with warm boric acid solution until the whole can be removed without difficulty. It may be necessary to remove the dressing piece by piece down to the last layer. The best means of applying the solution is to wring it out from pledgets of cotton which are saturated with it.

Plenty of time should be taken in all manipulations about the eye, as one false or hurried move might result in defeating the whole purpose of the operation. It is perhaps best to use forceps in removing a dressing, as greater delicacy of touch can be obtained than with the fingers themselves.

The bandage and pad having been removed, any secretion on the lids should be very gently wiped away, particular attention being paid to the margin of the lids and to the cilia. If necessary, a pad saturated with warm boric acid solution should be laid over the lids for a short time in order that the agglutination may be overcome. Great care should be observed in opening the lids, when this is necessary, as, for instance, when the patient is unable to do it spontaneously. When they are finally open, their margins should be very gently wiped free from all secretion. The eye is now inspected. It is usually necessary to illuminate the field with the magnifying lens, which focuses the rays from a candle or other source of light upon the region of the eye. If necessary, the sac is now very

carefully irrigated with warm boric acid solution. In cleansing the field surrounding an operated eye this should be done from the eye out to the region about; there is less danger of infective material being in the immediate field of the eye than farther out where protection has not been secured by the dressing. Thoroughly sterilized instruments and paraphernalia should be used for each new dressing, and always a new set for each new patient, in order to avoid the carrying of any possible infection from one patient to another. In case of operations on tear sacs, abscesses, carious bone, etc., it is often advisable to use xeroform dressings.

Bandages

Roller bandages are usually made out of unbleached muslin, or, better still, out of a good quality of gauze. A gauze bandage can be applied to the head much more snugly, and therefore stands much less chance of becoming displaced. Starch bandages, or those prepared with silicate of soda, are also quite practical, especially in children and refractory adults. They are placed in a basin of warm water and allowed to remain until bubbling ceases, just as in the preparation of a plaster of Paris bandage, and are applied in the ordinary way. They become quite firmly fixed when dried. It must be remembered, however, that they contract quite considerably upon drying and should, therefore, not be applied too snugly.

The width of an eye bandage should be 1½ to 2 inches, and it should not exceed 3 to 5 yards in length. As a rule, one eye alone is bandaged, seldom both—except for a day or two following operations such as for cataract and plastic operations about the lids where all motion of the eye is to be avoided.

While most bandages are applied for the purpose of protection from injury or entrance of septic material, or for immobilization of the lids, a roller bandage is also used in cases where pressure is desired. In such cases it is applied to control hemorrhage, or prevent perforation of the floor of a corneal ulcer or any bulging of the cornea. When pressure is desired, the irregularities of the orbit are filled out with cotton, in order that no unequal pressure be exerted upon the bulbus, and a bandage applied as directed below. Neglect of this apparently

insignificant precaution of padding out the irregularities might result in loss of an eye. Care should be taken in the application of the ordinary bandage that undue pressure be not exerted; this not only produces discomfort to the patient, but may, in fact, act deleteriously upon the result of a delicate operation, as for instance, where the anterior chamber has been opened and springing of the wound might be caused. Closure of the wound might also be prevented. It is, perhaps, always best to use pins in fixing a roller bandage, these being placed in the most accessible positions, and particularly at the intersections of the turns of the bandage. They should never be placed at the back of the neck, however, owing to the discomfort produced when lying

Fig. 37. "Triangular" Bandage.

down, and also on account of their inaccessibility when in that position. The pin should be passed through several thicknesses of the bandage. In extremely refractory patients it may be necessary to tie the hands, although if a starch bandage be used, or, better still, a zinc adhesive plaster bandage, they can usually do themselves no harm. They are particularly likely to leave the latter bandage in place, as it gives rise to discomfort when an effort is made to remove it.

Triangular Bandage

This latter bandage, which may be called the "*Triangular bandage,*" is perhaps the most generally useful of all eye bandages. The ordinary pad is applied as already described, the upper margin of it covering the eyebrow. This pad is held in

place by three strips of zinc adhesive plaster about an inch wide and three or four inches long; one of them may be about one-half inch shorter than the other two, and is the last to be applied. Three strips are attached as follows: The first is laid horizontally over the supraorbital edge, including the upper margin of the pad; the second starts from the nasal end of the first and is carried down and out along the side of the nose onto the cheek, thus fixing the inner margin of the pad; the third and final strip fixes the outer margin of the pad, and is attached to the temporal end of the first strip, and placed in a direction down and in, meeting the lower end of the second strip on the cheek. By this means the dressing is kept securely in place, and has as a particular advantage the fact that it will not slip off during the night. This bandage is, of course, purely protective and exerts no pressure.

The aluminum shield and other devices of like nature for the purpose of securing additional protection can also be applied with this dressing, being fixed in place by the adhesive strips.

In removing the bandage, detach first the upper end of the triangle and pull down and out—never from below, as this would be against the direction of the hairs. It is best to follow along with the finger in order not to exert too much traction on the skin—that is, detach the plaster for about an inch, and then place the finger up to where the plaster is still attached and detach another inch, and so on until it is entirely removed. Or one can follow along with a pledget of cotton just moistened with deodorized benzin. This is also very effective in removing the adherent substance remaining on the cheek. When using any such substance the patient must, of course, be instructed to keep the eyes tightly closed. The field should also be washed off with water before the eyes are again opened.

Some surgeons prefer to close the lids with a single strip of isinglass plaster placed vertically over them. It is usually very unpleasant, owing to its stiffness.

There are various *tie bandages* used, particularly during the after-treatment, because of the ease with which they can be removed, and the fact that it is no longer necessary to use any other precaution than mere protection from light and accidents.

Moorfield's bandage consists in a piece of linen 3x7 inches. In case both eyes are to be covered a niche can be cut for the bridge of the nose. There are four tapes, one at each corner, so arranged that loops are formed and surround the ears; the

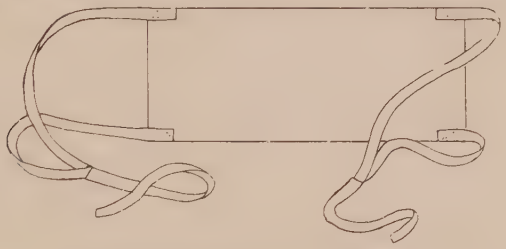

Fig. 38. Moorfield Bandage.

tape is then carried around the occiput and up to the forehead and here tied. The single form of this bandage has a single tape on one side, and a double one which surrounds the ear on

Fig. 39. Single Roller Bandage.

the other. There are various modifications of this bandage, but that above described is perhaps the most practical.

Roller bandages are either single or double. In the application of a single bandage one begins on the forehead just above

the affected eye, holding the free end of the bandage with the thumb of the disengaged hand; the bandage is carried around the forehead across the opposite temple, obliquely down around the occiput, up under the ear of the affected side, and thence obliquely across the dressing covering the eye. If more than one thickness be desired, which is usually the case, repeat the turns—except that on the last turn pass above the ear of the affected side, then on the next round below the ear, and so on alternately as often as required.

Fig. 40. Double Roller Bandage.

For the *double roller bandage*, follow the same procedure, except that when the bandage reaches the center of the forehead on the last turn it is secured by a safety pin and the order of application reversed. It is now passed obliquely down over the dressing of the second eye, under the ear, then across the occiput and up over the ear of the first side to the forehead. Either secure here, or repeat the turns according to the thickness desired.

Figure of Eight (Single). In bandaging the right eye, for instance, the free end of the bandage is held in place on one

temple by the thumb of the disengaged hand, two circular turns are made around the forehead from right to left, and on the third turn the bandage is brought up under the right ear and obliquely across the right eye. It is now continued across the forehead and the opposite temple, then around under the occiput. and again under the right ear. These excursions may be repeated several times, each time exposing the lower third of the preceding turn. Finish with a circular turn around the forehead and secure with a safety pin. For the left ear the directions are, of course, reversed.

Figure of Eight (Double). Proceed as in applying the single bandage, except that when the last oblique turn reaches the

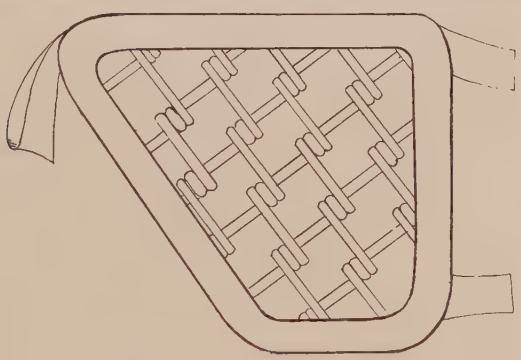

Fig. 41. Fuchs Wire Mask.

parietal region pass around the forehead instead of under the occiput, then down over the left eye and under the left ear, then twice obliquely around as on the other side, and finish with a few circular turns around the forehead.

Protective Frames

These are of all varieties, and are made to suit individual cases as well as for general use. They are used chiefly following cataract operations and operations in which the bulbus has been opened, where it is quite necessary to avoid any possible injury to the eye, such as a blow or accidental contact with the hand during the course of healing. Patients often leave their beds, even against orders, and unless some means of protection is afforded them they are just as likely as not to come into contact with some sharp corner or some object of furniture. The

mask of Fuchs is perhaps the most practical. This is made of wire, with a pad around the margins, as shown in the accompanying illustration. It may be either single or double, the latter being seldom required, as it is very rarely, if ever, that both eyes are operated upon at the same time. A papier maché mask is also used; an opening may be made for the sound eye, when it is to be left exposed. It may be applied over the bandage. It is lined with linen and covered with silk, and has the advantage of being easily formed to fit the face. This is also of value as a protection from injury to the eye at night, when the triangular adhesive bandage is not well borne.

Eye Shades

These are made single and double, and are familiar to

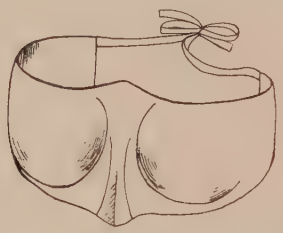

Fig. 42. Ring's Ocular Mask.

everyone. They are green on the concave side and black on the convex side, the latter, of course, being the outside. A piece of gauze may be pinned on the side next to the eye, if so desired. This is done by sticking a pin downward between the layers forming the pad, at each upper corner, catching just the upper margin of the gauze. The pin should be wholly hidden with the exception of the head. Or the gauze can be held in place by cutting it somewhat larger than the pad. These shades have a string attached to each of the upper corners, and are used not only for the exclusion of light and protection in case of inflammation, but also for cosmetic reasons. They are made of various materials, such as cloth, paper, celluloid, etc. In the latter case they are usually flesh colored. There is one danger connected with their use, and that is the danger of conveying infection in case more than one patient uses the same shade. They should always be prescribed new for each patient, and

destroyed when no longer needed. They may be applied with the triangular bandage.

Dark Glasses

These are frequently prescribed in the after-treatment of operations as a means of protection against light, wind and dust particles. They are also applied in case of diseased eyes, external and internal, where protection from light is required, but not necessarily a bandage. In case of mydriasis, particularly where this is to last for a week or more, they are indispensable, owing to the irritation of the interior of the eye which so frequently follows exposure to bright daylight or artificial light. These glasses are of various colors—amber, blue, green, violet, and the so-called "smoked glasses." The latter are usually called "London Smokes" and are probably the best. The dif-

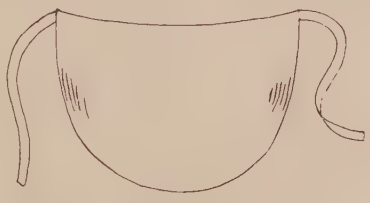

Fig. 43. Ordinary Eye Shield.

ferent degrees of color are indicated by numbers; No. 1 being the lightest tint, No. 2 medium, and No. 3 very dark. Number 2 is usually ordered. Goggles are really the most practical, when it is desired to isolate the eyes as much as possible from external influences, although it is difficult to prescribe them owing to the prejudice which exists against their very unbecoming appearance. Dark glasses are also prescribed for cosmetic reasons, in cases where the condition of the eye is unsightly, or where the eyeball has been entirely removed and no artificial eye used. These glasses may also carry infection, and should be disinfected before being prescribed a second time. A tender skin which resents the long-continued wearing of spectacles may be hardened with alcohol or strong salt solution, care being taken to keep the eyes closed during their application. The glasses may be discarded a day or two at intervals if found to be too irritating. When they become greasy and dirty, a little ammonia in water will be useful in cleansing them.

Artificial Eyes

These are thin glass shells made to resemble the front part of the eye in shape and color. They are worn after enucleation of the eyeball or removal of its contents. Where simple evisceration has been performed, or the muscular attachments preserved, the ability to move the eye is retained to a great degree, and it is often quite difficult to tell which is the artificial and which the natural eye. An artificial eye is usually first put in place at the end of the second or third week, but should not be worn during the presence of any inflammation or discharge. An hour or two a day is sufficient to wear the eye at first, as it

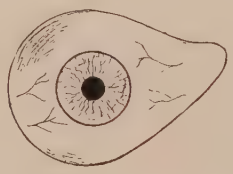

Fig. 44. Artificial Eye.

may act as a foreign body and set up an irritation. It is gradually worn for longer periods until it can be tolerated for the entire day. It is, of course, removed at night, and should be cleansed and laid aside in a clean place, or kept in a glass of water. The eye will last for one or two years with ordinary wear, when the surface gradually loses its polish. Before applying the eye for the first time the sac should be well irrigated with boric acid solution, and, if necessary, in very sensitive subjects, a drop of 2 per cent cocain may be introduced. The introduction of the shell is often facilitated by previous moistening.

Method of Introduction. Take the shell between the thumb and index finger of the right hand. The fingers of the left hand are placed upon the forehead, palm in, and the thumb about the middle of the upper lid, which is now pulled upward. The shell is now inserted underneath the upper lid, broad end first, and gradually raised to a horizontal position with the narrower end toward the inner canthus. It is now held in this position by the thumb of the left hand, and with the thumb of the right hand the lower lid is pulled away and the shell allowed to slip into the conjunctival sac. The lower

lid, upon being released, assumes its normal position, and the eye is in place. It should not feel uncomfortable.

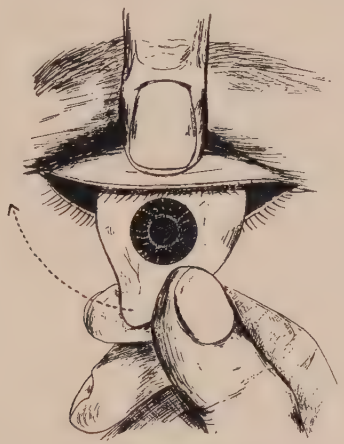

Fig. 45. Introducing Artificial Eye (Left).

Method of Removal. The patient is told to look up, the lower lid is again everted, and the nail of the thumb or index finger placed underneath the lower margin of the shell in such a manner as to dislodge it. It will usually fall out without

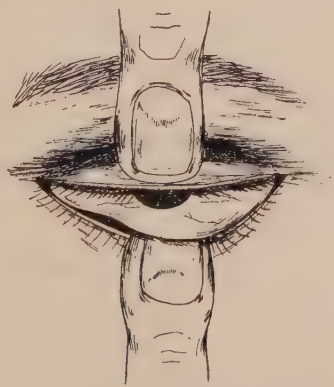

Fig. 46. Removing Artificial Eye (Left).

any assistance, and it is, therefore, wise to have a little pledget of gauze or absorbent cotton with which to catch it; or it may be allowed to fall into the palm of the hand. Instead of using the thumb or finger to pry it out of the sac, the round end of a

hair pin may be substituted, it having first been sterilized. The eyes, being very fragile, should not be allowed to fall on the floor. Never use forceps in the introduction of an artificial eye, as they scratch it and make it unpleasantly rough. In children it may be advisable to have a small hole bored in the shell near the lower margin, by which it can be grapsed with a

Patients can very readily be taught to introduce and re-
hook.
move an artificial eye; children are particularly apt.

The eye may be defective and cause discomfort and irritation. It may also be too large, or the movements may not correspond to those of the stump. It may also fit improperly, so that it falls out of the sac without apparent provocation. It may cause pain on account of roughness; or it may give rise to a discharge. In the presence of irritation and discharge a piece of sterile wool moistened in boric acid may be inserted into the socket at night; or a thin layer of wool impregnated with an antiseptic solution may be worn behind the shell. Vaseline in the orbit also facilitates the movements and prevents irritation.

APPENDIX.

MOST COMMONLY USED EYE INSTRUMENTS.

Fig. 47. Lid Spatula.

Fig. 48. Ring Forceps.

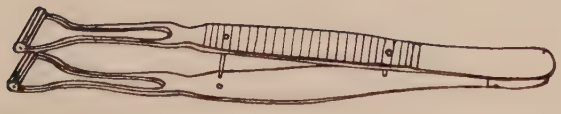

Fig. 49. Knapp Roller Forceps.

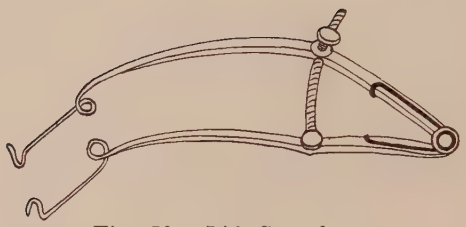

Fig. 50. Lid Speculum.

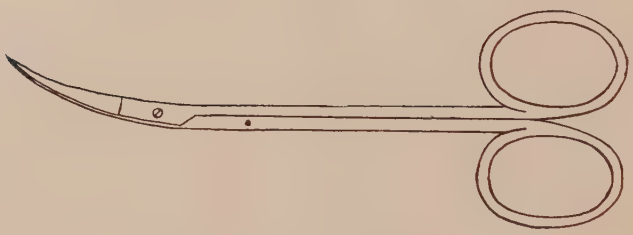

Fig. 51. Iris Scissors.

Fig. 52. Fixation Forceps.

Fig. 53. Iris Forceps.

Fig. 54. Keratome.

Fig. 55. Discission Needle.

Fig. 56. Cystotome.

Fig. 57. von Graefe Knife.

Fig. 58. Curette.

Fig. 59. Tattooing Needle.

Fig. 60. Strabismus Hook.

Fig. 61. Spatula.

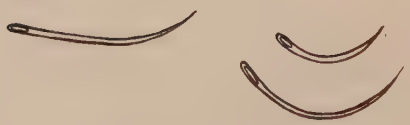

Fig. 62. Needles.

THE EAR.

CHAPTER VII.

ANATOMY, DEAFNESS, TUNING FORKS, INSPECTION.

In view of the fact that the names of anatomical structures will be repeatedly used in the description of various procedures about the ear, it may be well to enter into a brief consideration of the general anatomy of the organ before discussing these several procedures. It is obviousy essential that one be familiar with the various anatomical structures and their relationships, so as to be able to avoid doing injury to delicate structures through unfamiliarity with their location and importance.

For a brief consideration of the anatomy of the ear, the organ may be divided into four principle parts, viz., the auricle, the external canal, the middle ear, and the internal ear.

The *auricle* consists of a frame-work of cartilage, very irregular in form, covered by perichondrium and skin. The lower or pendant part is composed of fat and connective tissue, and is called the lobule. It will be necessary to remember only three additional names pertaining to the auricle, viz., the helix or rim of the auricle, the concha or depression which leads on into the external canal, and finally the tragus or quadrilateral projection in front which forms the anterior wall of the concha. The auricle is supposed to have the function of collecting the sound waves for transmission through the external canal to the inner ear, although it is interesting to note that its absence does not seem to seriously impair one's ability to hear.

The *external auditory canal* is a blind canal about an inch in length and approximately one-fourth inch in diameter. It is formed of an inner osseous portion occupying two-thirds, and a cartilaginous portion, continued from the auricle, occupying the other one-third of its entire length. Where these two portions join an angle is present in the floor of the canal, but the roof is practically straight. In order to obtain a view of the drum

membrane which closes the inner end of the canal, it is necessary to overcome this angle in the floor by pulling the auricle upward and backward. In infants, however, the auricle must be pulled downward and backward owing to the fact that the superior and inferior walls are in contact, the bony meatus not having been developed (Dench). The depth of the canal is therefore much less than in the adult. The cartilaginous portion of the canal is not complete in its circumference, and is in reality only one-half of a cylinder of cartilage, the posterior half being replaced by membrane. The whole canal is lined by skin continued from the general skin of the body. It becomes thinned out as it approaches the drum membrane, which it covers as a

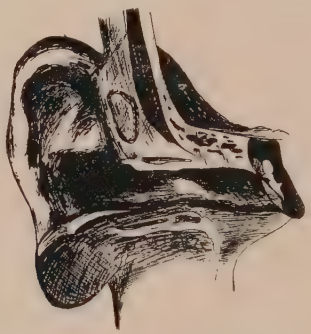

Fig. 63. Vertical Section Showing Auricle, Canal and Tympanum.

very delicate, transparent layer of epithelium. It is tightly adherent throughout, thus accounting for the extreme painfulness of furuncles or other inflammations of the canal.

At the inner end of the cartilaginous portion, that is, just within the canal, are the ceruminous glands which normally secret a small quantity of thin, yellowish-brown, sticky wax, having a very bitter taste. This wax prevents the entrance into the canal of insects or foreign bodies, a function also performed by the hairs which partly occlude the opening to the canal.

The *tympanic membrane* is a strong, elastic membrane, oval in shape, approximating three-eighths of an inch in diameter, and placed obliquely at the inner end of the external canal. It is not a perfectly flat membrane, as one might suppose, but is depressed inward, and might be said to be slightly

funnel-shaped. The concavity is outward. It consists of three layers, viz., an external one, formed by the skin of the canal, a middle supporting layer, and an inner layer formed by the mucous membrane lining the tympanic cavity. The membrane is of a pearly-gray color and is highly polished in the normal state. The blood vessels run down from above along the handle of the malleus, one of the delicate bones inside of the ear. This bone, which shows through the drum membrane, together with an imaginary line drawn from its tip to the bottom of the canal, serves to divide the membrane into two segments, an anterior and a posterior. The posterior is the larger of the two segments. Starting off from the tip of the malleus and running downward and forward on the membrane is a bright reflex of

Fig. 64. Tympanic Membrane.

light, the so-called "cone of light," which is of triangular form, with its base toward the periphery. These are known as landmarks of the membrane, and when they are not visible some abnormal condition of the membrane is present. The drum membrane assists in propagating the sound waves to the perceiving apparatus, and also acts as a protection to the delicate structures within. It shows a remarkable tendency to heal after having been punctured, an aseptic wound usually closing in twenty-four hours. It is interesting to note that total absence of the drum membrane is not incompatible with reasonably good hearing. The membrane in children is situated quite close to the surface, a fact which should be borne in mind when dealing with their ears.

The middle ear is not alone the tympanic cavity, as would naturally be inferred, but comprises as well the Eustachian tube, the mastoid antrum, and the mastoid cells, all of which

parts communicate with one another, and all of which are lined by a continuation of the same mucous membrane which lines the nose and throat. The middle ear is, in fact, an irregular offshoot from the naso-pharynx, having as a vestibule the bell-like extremity of the trumpet-shaped Eustachian tube. This little trumpet, so to speak, is about one-half inch in length, its mouthpiece opening into the tympanic cavity, and its bell opening into the naso-pharynx. The third of the tube nearest the tympanic cavity is formed of bone, and the other two-thirds are

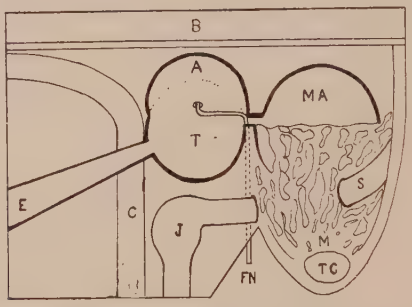

Fig. 65. Diagramatic Representation of Middle Ear. B, brain; A, Attic; T, Tympanum; MA. Mastoid Antrum; E. Eustachian Tube; C. Carotid Artery; J, Jugular Bulb; FN, Facial Nerve; M, Mastoid Process; TC, Tip Cell; S, Sigmoid Sinus.

formed of cartilage and membrane. The tube has a direction upward, backward and outward. The mucous membrane lining the walls of the cartilaginous portion are in apposition except at the pharyngeal mouth. The fibres of the tensor palati muscle are attached at right angles to the floor of the tube, so that when the palate is made tense, as in the act of swallowing, the walls of the tube are pulled apart. The levator palati has also a relation to the tube, but its function is not of so much importance.

The *tympanic cavity,* or "drum" of the ear, does, in reality, somewhat resemble a drum, in that it is a flattened space having one side closed by a vibrative membrane. The narrowest measurement is between the drum membrane and the posterior wall of the space, this being about one-twelfth of an inch. The widest measurement is from the opening of the Eustachian tube to the opening into the mastoid antrum, about five-eighths

of an inch. From the roof to the floor is about one-half of an inch. This measurement of one-half inch includes the space known as the attic, which lies immediately above the tympanic cavity, from which it is separated only by membrane. The attic contains the greater portion of two of the three delicate bones which form a chain across the tympanic cavity. The bones are the malleus (or hammer), and the incus (or anvil). The long process or handle of the malleus is firmly attached to the tympanic membrane, and is the part spoken of as dividing the membrane into two sections. The body of the malleus articulates with the incus, and this latter bone in turn articulates with the stapes (or stirrup), the third bone of the chain. The

Fig. 66. Malleus.

Fig. 67. Incus.

Fig. 68. Stapes.

plate of the stirrup fits in a little oval window which communicates with the complicated internal ear where the sound-perceiving apparatus is located. The whole tympanic cavity is lined by the mucous membrane continued from the Eustachian tube, and this membrane is also spread over the delicate bones forming the chain. In addition to these structures in the tympanic cavity there is the tensor tympani muscle, a delicate little muscle coming out of a minute bony canal above the Eustachian tube and attached to the malleus. This muscle regulates the position of the drum membrane. Running through the cavity on its way to the tongue is the chorda tympani nerve.

The close relationship to the tympanic cavity of the following structures should be kept in mind. That portion of the brain occupying the middle fossa of the skull is separated from it by its dura mater and only a very delicate plate of bone; the facial nerve is situated very superficially in the inner wall of the cavity; the jugular vein lies just underneath the floor, only a very thin plate of bone intervening; the carotid artery also lies in such close relationship that carious processes very often

cause erosion of its wall. The mastoid cells are separated from the external canal by a plate of bone of variable thickness. Communicating with the tympanic cavity by a very small opening situated high up in the posterior wall is the mastoid antrum, an irregular air cell of quite variable size. It is usually about the size and shape of an almond seed. The roof of the tympanum and of the antrum are formed by the same plate of bone. The antrum communicates in turn with the cells occupying the mastoid process, a collection of cells filled chiefly by air, but in some instances by a fatty substance. These cells, as well as the mastoid antrum, are lined by mucous membrane continued from the tympanic cavity.

The *internal ear* is much too complicated and inaccessible to treatment to demand any consideration in a work of this character. It will suffice to say that it is divided into three principle parts, viz., the semi-circular canals, the cochlea, and a vestibule which connects these two structures. The cochlea contains the organ of Corti, an extremely delicate apparatus in which the auditory nerve fibres terminate. The sound waves are communicated to these terminal filaments through the fluid filling the spaces of the internal ear, this fluid being set into vibration by the movements of the stapes which, as was before mentioned, fits into a little window in the inner wall of the tympanic cavity.

Deafness

This may be due to interference with the conduction of sound waves to the internal ear, or to some difficulty in the perceiving apparatus. It may also be of a functional nature, as, for instance, inattention.

Sound waves reach the ear in two ways, viz., through the air in the external canal, and through the bones of the skull. To recapitulate what has been said in the anatomy, sound waves travel through the external canal, impinge upon the drum membrane, and cause the little chain of bones to vibrate. This vibration is in turn communicated by the stapes to the fluid contained in the internal ear, and thus reaches the delicate nerve terminations which float in this fluid. The sound waves are prevented from reaching the perceiving apparatus if, for instance, the external canal is occluded by wax, foreign bodies,

swellings, growths, or collapse of the walls, such as quite frequently occurs in old people; or they do not reach the perceiving apparatus if the little chain of bones becomes immobilized from any cause. This immobilization is usually brought about by catarrhal conditions in the middle ear, swelling of the mucous membrane, adhesions, exudates, mucous, pus, blood, etc. So long, however, as the stapes remains freely movable, reasonably good hearing will be retained. Even though the drum membrane be totally destroyed or the other two bones removed, the patient may hear quite well, provided there is no affection of the internal ear or nerve. The vibration of the fluid may be interfered with owing to a swollen condition of the lining membranes, extravasation of blood or serum, disease of the bone, etc.

The fluid of the internal ear may also be set in motion by vibration of the bones of the skull, as is shown by placing a tuning fork or any vibrating body against the head, whether in the immediate neighborhood of the ear, on the forehead, or against the teeth. If, however, some affection of the nerve itself exists, such as, for instance, degeneration through syphilis or scarlet fever, or if the nerve has suffered through injury, pressure or perhaps caries of the surrounding bone, no sound will be perceived regardless of the fact that all the structures concerned in transmitting the sound waves are in a perfectly normal condition.

Tuning Forks

These are used as a means of determining bone conduction. The forks are of various sizes and degrees of pitch, but for all ordinary purposes one six or eight inches in length, with a pitch of C, having 512 vibrations per second, is perhaps the most generally satisfactory. Clamps on the limbs of the fork practically destroy the disturbing harmonics or over tones. The degree of pitch can be elevated by sliding the clamps toward the handle, in case it is desired to test the perception of higher tones.

While there are several methods employed, the two most satisfactory ones are those of Weber and Rinne.

Weber's test is for the detection of an obstruction either in the external canal or tympanic cavity which interferes with the

entrance of sound waves. To demonstrate the test, an obstruction can be temporarily produced by pressing the finger tip firmly into the external meatus. The fork is set in vibration

Fig. 69. Tuning Fork.

by tapping it on the knee, or by grasping the ends between the thumb and first finger of the left hand and sliding them off while still maintaining pressure. The handle of the fork is

now placed in contact with the forehead, bridge of the nose, or vertex of the skull, at right angles to the surface and directly in the median line. Pressure as firm as the patient can comfortably stand is exerted. If no obstruction exists the patient will state that he hears the tone "everywhere"—that is, he is unable to locate it accurately. If an obstruction exists, however, in one ear or the other, he will locate the sound more distinctly in the affected ear regardless of the position of the fork on the head.

Rinne's test is somewhat more complicated, but equally easy of application. In this test the handle of the fork is placed in contact with the head a short distance above the tip of the mastoid process, and allowed to vibrate until the tone is no longer perceived. It is well to remove it from time to time, test it on one's self (if one's hearing is normal), and reapply it. The auditory nerve becomes easily fatigued under the circumstances and the patient will often be able to again perceive the sound upon reapplication when he has stated that it has entirely ceased. When the sound is no longer heard while the fork is in contact with the head it is quickly transferred to the orifice of the ear. If it is here again perceived, the test is said to be Rinne positive (R+); but if no sound is heard upon the transference the test is said to be Rinne negative (R—). Care should be taken that the fork does not touch the ear when it is transferred from the head. It should also not be held at an angle to the ear. The sides of both limbs of the fork should be directed toward the orifice in order that the full benefit of the vibration may be obtained. Whether one hangs the fork by the finger tips before the orifice of the ear or holds it upright in the hand, is a matter of personal taste, although some authors claim an advantage in the former position. To hold the hand before the eye on the corresponding side in such a manner as to prevent the patient from seeing what is going on is often a valuable aid in dealing with those who are inclined to make use of their imaginations.

A positive Rinne is normal provided the duration of the perception of vibration is within the normal limits. Both bone and air conduction may be shortened, and yet the necessary relationship between their duration be preserved. The fork in

contact with the mastoid process is, as a rule, heard normally for about thirty seconds; by air conduction for about twice this length of time. When there is present a pathological condition of the labyrinth or of the auditory nerve this period is, of course, shortened to a degree dependent upon the amount of involvement. Bone conduction is reduced after the age of 45 or 50. A negative Rinne test with normal bone conduction indicates an obstruction in the auditory canal, tympanic cavity, or Eustachian tube.

Inspection

In order to intelligently carry out manipulations about the ear, it is necessary that one be able to inspect the canal and

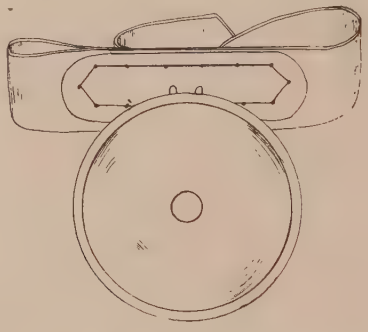

Fig. 70. Ear Mirror. With Head Band.

the drum membrane with at least a reasonable amount of skill. A few simple suggestions should enable almost any one to do this with sufficient skill to meet all the requirements demanded in routine treatment. For the purpose of inspection three things are required.

First, a special ear mirror. This is a round, concave mirror not more than three inches in diameter, with a central perforation through which one looks. This can be held in position before the eye by means of the attached band which is placed contact with the mastoid process is, as a rule, heard normally around the head; in case of treatment this is almost indispensable, although for mere inspection the mirror can be held with the hand.

The second requirement is a source of light, which, if artificial, is placed behind the patient on a level with his ear and quite near his head. In case daylight is used, the patient

stands or sits by the window with the ear to be examined turned away from the light; in this position the daylight is reflected from the mirror into the ear. In the home an electric drop-light with a frosted globe, or an ordinary student lamp, may be used. By wrapping a piece of tissue paper around the ordinary incandescent globe a very satisfactory uniform light is obtained.

Fig. 71. Inspection, showing Head Mirror, Fingers in Position, Source of Light, Applicator.

The third requirement is an ear speculum, although this is not always necessary, as many ears can be inspected without any such aid. These specula are of various sizes, shapes, and materials, being made chiefly of hard rubber and metal. The so-called Gruber's speculum, which is made of metal, is perhaps the most satisfactory, although any ear speculum will answer the purpose for inspection.

Great care must be observed in introducing a speculum. It should not be pushed in so far as to feel uncomfortable, nor should it be introduced incautiously in the presence of any inflammatory condition of the external canal. Its introduction

may excite reflex cough. In very sensitive subjects it might be well to warm the speculum before introducing it. It should be cleansed thoroughly after each time it is used, and particularly after having been used in suppurative cases. Some authors recommend keeping the specula in a 5 per cent solution of carbolic acid in glycerine, rinsing off the excess solution with warm water upon removing them from the container. This method is satisfactory so far as metal specula are concerned, but the rubber ones are eventually damaged by being allowed to remain in the solution.

Fig. 72. Gruber Speculum.

To inspect the drum membrane and the canal, it will be necessary to overcome the angle in the floor, and this is done in the adult by pulling the auricle upward and backward. In infants and in little children, however, it must be pulled downward and backward, as explained in the section on anatomy. The auricle should never be seized roughly, or strong traction made until it and the opening to the external canal have been inspected. In the presence of inflammatory conditions in the external canal pulling on the auricle would give rise to extreme pain, and might prevent a further examination from being made. The best means of holding the auricle up and back while inspecting, is by placing the index finger in the concha and the middle finger behind the auricle. In this way the auricle is held firmly between the fingers, and at the same time the index finger and the thumb can be used for holding the speculum in place and rotating it at will.

Upon straightening the canal, introducing the speculum, and looking downward and forward in a direction somewhat corresponding to that of the tip of the nose, one obtains a view

of the drum membrane, provided there be no obstruction in the canal. The appearance of this membrane has already been described in the section on anatomy. Cerumen, when present in excessive quantity, is usually recognized as a dark brown mass with a somewhat glistening surface, and is generally situated quite superficially. Purulent secretions, if present in large quantity, are as a rule easily recognized, although small amounts often escape detection. Pulsation of the secretion is not always an indication of perforation of the drum membrane, but a perforation almost always exists if pus is found in the external canal. It is not always possible to differentiate between foreign bodies and cerumen; in fact, they are very frequently coated with cerumen. The method of removal is the same in both cases, however, and an error in diagnosis is not of so much importance. Furuncles can often be easily seen and recognized unless they are deeply situated. Recognition of perforation of the drum membrane is sometimes very difficult, but a simple method of determining whether there is a perforation or not is to have the patient inflate the ears by the Valsalva method (to be described later), when, if the perforation be very small, a whistling sound will be heard. Patients are also often able to diagnose a perforation by their ability to blow smoke through their ears. Positive proof of a perforation can be had by placing one end of a rubber tube in the external canal so that it seals it tightly, and placing the other end of the tube in a vessel containing water. Upon inflating the ears by Valsalva's method bubbles will be seen to rise in the water.

The method of Valsalva consists in attempting to expire air while the lips are tightly closed, and both nostrils occluded by seizing the tip of the nose between the thumb and forefinger. Provided there be no perforation and the Eustachian tubes are potent, a sensation of fulness in the ears will be experienced. This is relieved by swallowing. There is always the danger of forcing secretions up into the middle ear, and it is best not to practice this method in the absence of perforation unless it be deemed absolutely necessary.

CHAPTER VIII.

SYRINGING, DRYING, INTRODUCTION OF REMEDIES.

Syringing

Having determined the presence in the external canal of foreign bodies, wax or secretions, these must of course be removed. Probably the most satisfactory method of accomplishing this is by the proper use of the syringe. Syringes are of various kinds, made of metal, hard and soft rubber, and glass. In the hands of the patient, or in the hands of one not thoroughly familiar with the use of the syringe, the ordinary soft rubber one is perhaps the safest, and is always to be prescribed to the patient for use at home. Under no circumstances should the patient be given a piston syringe, as he might inflict much damage to his ear. This soft rubber syringe consists of a bulb holding from two to six ounces, provided with a thin, tapering nozzle two or three inches in length, also of soft rubber and inseparably attached to the bulb. To fill this syringe, the air is expelled as completely as possible, the tip placed in the solution to be used, and there allowed to remain until the bulb fills of its own accord. The ordinary urethral syringe is not suitable

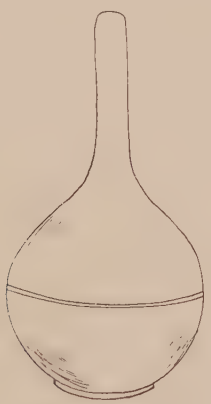

Fig. 73. Syringe—Soft Rubber.

for washing out the ear. This ear syringe serves very well in cases where it is desired merely to wash out the canal, but for the removal of cerumen or foreign bodies the regular piston syringe must be used in order to obtain sufficient force to dis-

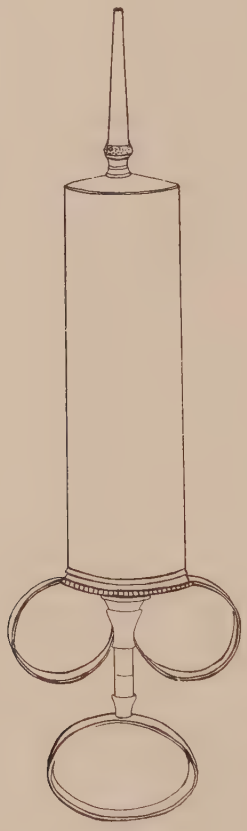

Fig. 74. Metal Barrel Syringe.

lodge the mass. For this purpose the all-metal syringe is perhaps the most desirable one, holding say from four to six ounces. It is provided with a thumb ring for the piston and two additional rings on the upper end of the barrel for insertion of the fingers. A thin, tapering, straight nozzle is much to be preferred to the bulbous one, as with the latter there is the danger of occluding the canal and preventing the return flow of the solution.

Before using the syringe it should be seen to that the piston is working smoothly, and that little pressure is required to force the solution out. There is usually little trouble in this regard when the all-metal syringe is used, for there is nothing to get out of order or to be injured by the solution, as is the case when the piston is made of leather. The metal syringes can also be kept much cleaner, and thoroughly sterilized as well. The reddish-brown color given to a clear solution expelled from a syringe with a leather washer is due to the fact that some of the solution has remained in the syringe and acted upon the leather. This will even occur regardless of the fact that proper efforts have been made to remove all the solution after the syringe has been used.

The solutions used for syringing the ear should never be cold. They should have a temperature of about 102 degrees, Fahrenheit.

As it is never known what condition underlies an impacted foreign body or cerumen, the solutions should always be sterile. For the removal of foreign bodies and cerumen, plain sterilized water will answer every purpose; or, in removing cerumen, if it is so desired, sodium bicarbonate may be added in the proportion of a drachm to the pint. If the sodium bicarbonate be used, the final syringing should be done with plain water in order that none of the solution remain in the canal. For therapeutic purposes, boric acid, an ounce to the quart, is also used; or a two per cent solution of carbolic acid is of some benefit. The latter is particularly valuable when the secretion has a disagreeable odor. Hydrogen peroxide, in the presence of a perforated drum-head, may excite very disagreeable symptoms, and, besides, its efficiency is a matter of some doubt. The ear should not be syringed when any suspicion of a ruptured drum-head exists. It is best to leave it alone. After suppuration is established it is permissible.

Only the smallest quantity of solution necessary should be employed, and it should be definitely ascertained that there is actually something present in the external canal before resorting to the syringe.

The frequency of syringing depends, of course, upon the amount of secretion present, or the difficulty encountered in re-

moving wax or foreign bodies. From two to four times a day is usually sufficient in the presence of discharge, unless it is being secreted in excessive quantities.

About a cupful of the warmed solution is used each time. For the removal of foreign bodies five or six syringefuls will usually suffice. Rather than excite unnecessary inflammatory reaction it would be best to postpone the effort until another time if more than this be required; or other means might be resorted to. Where cerumen is present in both ears, alternately

Fig. 75. Syringing, showing Syringe in Position, Irrigation Pan, Towel.

syringing first the one and then the other is often effective. This gives the solution a little time to act. The canal should be inspected from time to time in order to see whether one's efforts have been successful. Unnecessary syringing is thus avoided. Before using the syringe it should be filled once or twice with the warmed solution in order that the chill may be taken off from the instrument: otherwise the solution is not of the proper temperature.

To use the syringe, first place the nozzle in the solution and slowly withdraw the piston. If it be pulled out too rapidly a

vacuum is formed, and unless one waits until the solution slowly fills the barrel there is nothing but air in the syringe. While there is no particular objection to the presence of air bubbles in the syringe, it is nevertheless a source of discomfort to the patient on account of the noise produced. It is, therefore, best to invert the syringe and expel all the air bubbles just as one does before using the hypodermic.

The barrel having been filled with warm solution, and all the air bubbles expelled, the syringe is ready for use. The thumb of the right hand is placed in the ring on the piston, the first and third fingers through the rings on the end of the barrel, and the second finger allowed to rest against the barrel itself in order to obtain greater steadiness. With the thumb and forefinger of the left hand the auricle is pulled upward and backward to straighten the canal, and the point of the syringe is placed gently against the upper and posterior wall of the canal just at the opening; that is, provided there be no inflammation there. Any great pressure upon the canal wall should be avoided, and care should be observed that the nozzle of the syringe be not pushed into the canal when pressing the piston home. It may be necessary to apply the point of the syringe to other walls of the canal in order to get the most benefit from the force of the stream, but in all cases it should be applied against the wall and should not point directly into the canal. It is sometimes necessary to separate cerumen slightly from the wall before using the syringe. As the solution runs out from the ear it is caught in an irrigating basin or bowl held by the patient with the hand of the side opposite to that upon which the syringing is being done. A towel is placed over the shoulder of the patient underneath the irrigating basin, and at the same time that the basin is removed the towel is slipped up under it against the cheek, in order to prevent the excess solution from running down the neck. Rubber aprons are now quite frequently used, being fastened around the patient's neck by a clasp or spring. The pan should not be allowed to contain so much of the irrigating solution as to make it possible for it to run over onto the patient's shoulder. In fact, it should be constantly watched to see that the patient does not tip it over himself. A hard rubber irrigating basin will perhaps allow

one to see best what has been washed out, particularly in the case of pus, as the murky water is much more easily seen than is the case when white porcelain vessels are used. The little bones of the ear are not infrequently washed out from the canal, and it is therefore always wise to inspect the solution in the basin in order to determine what has been removed. Inclining the head to one side is often of service in removing foreign bodies from the ear, and also for the purpose of draining after syringing.

When through with the syringe all the solution should be expelled by vigorously pushing the piston home a half dozen times or more. This is particularly important when using a syringe provided with a leather dasher, as was before mentioned, as otherwise the syringe will soon get out of order. There is nothing more exasperating, and in fact dangerous, than a poorly working syringe. It is a good idea to remove the piston occasionally in order to cleanse it, after which it should be again lubricated with carbolized vaseline.

Various symptoms may be excited by syringing the ear, such as pain, dizziness, nausea, and perhaps vomiting. This is particularly true when using a cold solution. Many individuals are peculiarly susceptible in this respect, even though all precautions be taken, such as the avoidance of too much force, cold solutions, etc. It is more likely to occur when the drum membrane is destroyed totally or in part, owing to the fact that the fluid directly reaches the stapes. Upon drying the ear immediately the symptoms usually disappear. Holding the head to one side will also assist in restoring the patient to normal. When dizziness or faintness invariably occurs upon syringing the ear of a patient while he is in the sitting position, it is best to have him lie down during the procedure. Or if such symptoms persistently recur it may be necessary to resort to the dry treatment. It may be necessary to rely upon dry heat where the syringing has been used for the relief of pain. The amount of force used in syringing depends of course upon the effect desired. If for the relief of pain gentle syringing is sufficient, as is also the case when ordinary secretions are present. However, if wax or foreign bodies are firmly impacted it will often require as much force as the syringe is capable of producing.

Drying

The so-called dry treatment is sometimes used in place of syringing, the object being to remove as thoroughly as possible all secretion from the external canal without the use of a solution. Many advantages are claimed for it over syringing. At any rate, it is always necessary to dry the ear after having used the syringe and the procedure is the same in both cases. No fluid should be allowed to remain in the canal for any great

Fig. 76. Applicator.

length of time. A prerequisite to drying the external canal is a knowledge of how to roll the cotton on the applicator. These applicators are of all kinds. For all practical purposes the ordinary wooden one will answer. This consists in a plain, smoothly rounded stick, four or five inches long and about one-twelfth of an inch thick. Or, if these are not at hand, a toothpick will answer the purpose. Previous moistening of wooden applicators assists greatly in causing the cotton to adhere more firmly. Metal applicators having the last inch squared are very serviceable and permit of the easy removal of the contaminated cotton, whereas those with twisted or roughened ends test one's

patience greatly because of the difficulty of freeing them of the cotton. Whatever form is used the method of rolling the cotton is the same. A pledget of cotton about one inch square and one-quarter of an inch thick in the fluffy state, is placed at the ends of the index and middle fingers of the left hand. The point of the applicator is placed exactly in the middle of the piece of cotton, the handle being held at right angles to the end of the thumb. The part of the cotton next to the thumb is now folded over the point, pressure being exerted at the same time with the thumb, and the applicator is rotated with the fingers of the right hand. In this way the cotton is wound securely about the end of the applicator, leaving a fluffy projection out beyond the point. This serves the purpose not only of taking up the secretion, but, at the same time, of protecting the end of the applicator. The end must certainly be protected, for harm might be done deep in the canal were it to be left exposed. The size of the cotton tip depends, of course, upon the part of the canal to be reached, and also upon the size of the canal. If one is to reach the deeper parts, only a very small tip must be prepared, otherwise one would not go beyond the entrance of the canal. For general drying the amount above mentioned is quite suitable for the ordinary canal. After each introduction of the cotton carrier a fresh piece must be applied, the contaminated tip being removed by seizing the applicator with a small pledget of cotton just below where the cotton tip is applied and pulling it off with this.

In introducing the cotton tipped applicator into the canal, the auricle is pulled upward and backward as previously described. The carrier is held like a pen and the tip very gently introduced, with slight rotatory motion, down as far as the depth of the canal will permit. This should be done with good illumination, preferably with the mirror and source of light. The drum membrane should not be touched any more than is absolutely necessary in order to dry it. At home the patient can also dry out his ear successfully by adopting the method described by Barr. For instance, in drying the canal of the right ear, the left hand is placed over the head and the right auricle seized and pulled upward and backward. The patient now introduces the cotton tipped applicator downward and for-

ward as far as possible, as described above. For the left ear the reverse is of course carried out, that is, the auricle is seized by the fingers of the right hand placed over the head, and the applicator introduced with the left hand.

Introduction of Remedies

After having dried the canal, it is often desired to introduce remedies which are to remain until the next sitting. These

Fig. 77. Patient Drying Ear, showing Position of Hand, Applicator Ready for Introduction.

remedies are of several varieties, viz., drops, salves, powders.

Powders are not used with nearly the frequency that they formerly were, and should under no circumstances be intrusted to the patient for his personal use. Too much powder might be introduced into the canal, or it might not be washed out sufficiently, and as a consequence a solid mass might be formed with injurious results. Boric acid in the form of an impalpable powder is generally used, although this sometimes excites a copious watery discharge; in this case other powders must be substituted for it. The powder is introduced into the canal by the process of insufflation. This is performed in the following

manner: A small, short glass tube, or a little quill, is dipped in the powder, a small quantity remaining in the tube when it is withdrawn. A short rubber tube with a mouthpiece on one end for the use of the one insufflating, is now attached to the tube containing the powder which is simply blown into the canal of the ear. The auricle must be pulled upward and backward as usual in order that the powder may reach the deep part of the canal. There are also special powder-blowers consisting of a little container with a tube and bulb attached. Only sufficient powder is used to dust the parts over lightly. Large quantities cause retention of the secretion.

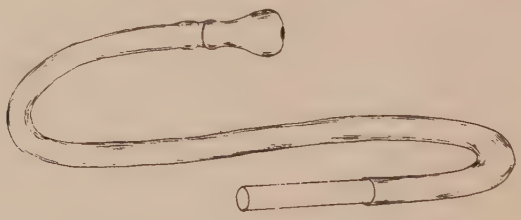

Fig. 78. Insufflator.

Insufflation is often combined with the moist treatment. That is, the ear is thoroughly syringed out and dried: any remaining secretion is forced out by inflating the ear through the nose (described later on); syringing and drying is again carried out, and after the ear is perfectly dry and free from secretion, powder is insufflated and the opening of the canal plugged with a small pledget of cotton.

Salves.—Various salves are used in the ear, but chiefly in the treatment of dry and eczematous conditions which are accompanied by much itching. Perhaps the most commonly used are ichthyol, zinc oxide, salicylic acid, and bichloride of mercury. These may be painted upon the walls of the canal by means of a cotton-tipped applicator, prepared as above described and anointed with the salve; it being simply smeared over the walls of the canal under proper illumination. If it is desired to leave an anointed plug in place, smear the salve over the walls, slide the cotton tip off from the applicator and introduce it into the canal large end first. The projecting tip of the cone renders it easy of removal either by the one who has introduced it or by

the patient himself. For deep application it must, of course, be pushed down into the canal as far as it will go. The application of this plug is of particular importance in the treatment of furunculosis of the external canal. In such cases a salve of menthol, or iodoform, or simple carbolized oil, is generally used. The plug should be left in place twenty-four hours. Thin compresses soaked in salve may be applied to the auricle and surrounding parts at night. When applied to the auricle they should be pressed into all the little irregularities so that all parts are reached. The application of these compresses may also be necessary in neglected cases where the secretion has been allowed to collect in the canal and run over the auricle and side of the face. An unsightly mass of crusts and scabs is often produced from this cause. These must, of course, be removed before any remedy is applied, and the application of pieces of lint soaked in vaseline, sweet oil, or olive oil, is almost essential to their removal. The salve does not need to be applied in large quantities; there is needed only sufficient to saturate the lint. The compress may be covered wth oiled silk to prevent soiling the pillow.

Drops.—The most important procedure to be considered in this section is the introduction of drops into the canal of the ear. The purpose of these drops is either to relieve pain, dissolve cerumen, or to act antiseptically. They should always be warmed before introduction, and this may be accomplished either by placing the bottle in hot water, or by putting the drops in a test tube which is heated either in hot water or over a flame. They may also be heated in the pipette used for their introduction by passing it several times through the flame. They should never be introduced into the canal, however, without first having tested their temperature by allowing one or two drops to fall on the back of the hand. The point of the dropper is placed just at the entrance of the canal, and not deep in the canal unless for the introduction of nitrate of silver drops or some solution which is likely to discolor the skin. In this latter case, after the drops have remained in the canal for the desired length of time, they should be withdrawn with the pipette and not allowed to run out over the auricle and face. This is of no

importance in the use of other drops, although it is best to catch them with a piece of cotton held near the opening of the canal. To remove the drops, the bulb of the pipette is simply compressed and the point introduced into the canal. Upon releasing the pressure on the bulb the solution is drawn up into the pipette just as when it was taken from the drop bottle.

Before introducing drops for the relief of pain inspect the canal to see that no obstruction exists. If any be present, this must first be removed. Mere wiping out may be sufficient, but it is sometimes necessary to resort to the syringe in case of cerumen or excessive secretion. The patient lies on the side opposite to that of the affected ear. The auricle is gently pulled upward and backward, and about thirty drops allowed to run in. In cases where it is desired to reach only the middle ear, five or ten drops are usually sufficient. Their entrance into the tympanic cavity may be assisted by making pressure with the finger upon the tragus, or by closing the mouth, holding the nostrils closed with the fingers, and swallowing—the so-called Toynbee experiment. Upon doing this the solution may run into the throat, but this is of no consequence. By holding the head in various positions the several parts of the ear can be more readily reached. For instance, where it is desired to reach the mastoid cells the head should be held back; to reach the Eustachian tube the head should be held forward. Such efforts are not always successful, but the possibility of their being of assistance warrants at least a trial.

As to the kind of drops. Those for the relief of pain may be simply water or a few drops of laudanum, as hot as can be borne; or carbolic acid 5 to 10 per cent in glycerine may be used. About ten drops of this later solution are introduced into the canal of the ear while the patient is in the recumbent position or has the head flexed strongly to the opposite side. The drops are allowed to remain ten minutes. At the expiration of this time a pledget of cotton is placed against the meatus, the head inclined to the opposite side and the drops allowed to run out. The meatus is then stopped with a pledget of cotton and the excess solution allowed to remain in the canal. This can be repeated every half hour if the degree of pain seems to demand it. For the application of a carbo-glycerine

plug or cone, this should be prepared with the applicator as previously described, and saturated with the solution. It is now held over a flame until heated to the greatest degree of tolerance when placed upon the back of the hand, removed quickly from the applicator and inserted, large end first, into the canal so that the cotton rests against the surface of the drum membrane. It may also be introduced by means of a slender aural dressing forceps. The pointed end of the cone projects from the meatus and permits of its easy removal. The cone should fit the canal snugly. It has several advantages, viz., the application of heat, the antiseptic effect of the carbolic acid, and the relief of the congestion by the dehydrating effect of the glycerine. It may be left in place for several hours unless it is found necessary to reapply it on account of the return of pain. Immediately after its introduction dry heat is applied according to any of the methods previously described.

A cotton cylinder saturated with peroxide is often introduced into the canal and allowed to remain a few moments for the purpose of dissolving crusts and accumulations of wax. The canal should be gently irrigated thereafter. Bougies are also used in the canal. These contain carbolic acid, cocain, atropin, etc. The canal is first cleansed. Immediately before insertion the suppositories are dipped in water as hot as the hand can bear, and are thus rendered flexible and easy of introduction. They should be inserted deep into the canal, the meatus of which is plugged with a pledget of cotton to hold the suppository in place. Following this dry heat is applied. These are not of so much value in purulent conditions. They usually require reduction to smaller size in the case of children.

Drops used for their antiseptic properties are of numerous varieties. The combination of boric acid in alcohol and water is perhaps the best and most satisfactory in suppurative cases. The strength of the alcohol for the first application is about one drachm to the ounce, boric acid being added in the strength of 3 per cent. The strength of the alcohol is gradually increased until finally absolute alcohol is used. The canal is thoroughly syringed and dried. The patient lies on the side opposite to the affected ear. One or two drops of the solution

are placed in the canal, this producing at first a feeling of warmth, or in some cases, considerable pain and discomfort. These symptoms soon pass away, and the remaining eight or ten drops can be introduced without exciting any symptoms. The drops are allowed to remain in the canal about ten minutes, when the head is inclined to the other side in order to allow the excess to escape. Then without drying the canal, the external meatus is plugged with a pledget of cotton which is allowed to remain in place until the next treatment. It may be necessary to replace it sooner, however, depending upon the amount of discharge. In cases where the discharge is excessive this procedure may have to be carried out five or six times a day.

For dissolving cerumen, a solution of sodium bicarbonate 4 per cent in equal parts of water and glycerine is effective. A half dozen drops are placed in the canal and allowed to remain a few minutes, when the meatus is plugged with cotton without allowing the drops to escape. This process of dissolving the cerumen is a tedious one and is only resorted to when the wax is so hard and adherent as to make its immediate removal with the syringe a difficult matter. Full strength hydrogen peroxide is also used by some.

CHAPTER IX.

INFLATION, MASSAGE, LOCAL ABSTRACTION, HEAT AND COLD.

Inflation or Politzerization

This method originated with Prof. Adam Politzer in Vienna, and therefore bears his name. It is used for the purpose of opening the Eustachian tubes, to prevent the forma-

Fig. 79. Politzer Bag and Nose Piece.

tion of adhesions around the delicate structures within the tympanic cavity, and for driving secretions out of the middle ear. It should never be resorted to when the middle ear is acutely inflamed. It is always wise to have the nose thoroughly cleansed before inflating the middle ear, as otherwise secretions might be blown up through the tube and cause seri-

ous mischief. If spraying and cleansing solutions are not available the nose should at least be thoroughly blown.

For performing Politzerization two things are required—a Politzer air bag, and an auscultation tube, although the results with the latter are so uncertain that it could easily be dispensed with. There is usually too much noise connected with the process to permit of hearing anything with the tube. An auscultation tube consists of a piece of light rubber tubing about two feet long in each end of which is inserted an olive-shaped ear piece. The Politzer bag is a pear-shaped bag of rubber, holding from six to twelve ounces. One with a capacity of eight ounces is perhaps the most easily managed. To

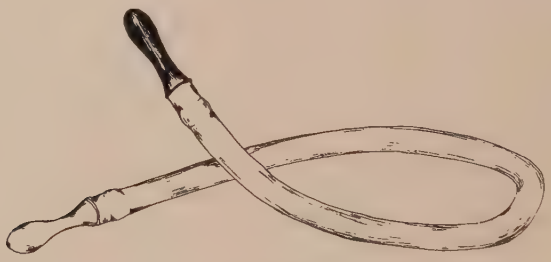

Fig. 80. Auscultation Tube.

the pointed, hard-rubber tip which is fixed in the small end of the bag is attached a piece of rubber tubing eight or ten inches long. In the free end of this is inserted an olive-shaped nose piece preferably of hard rubber. It is well to have this nose piece of good size as the smaller ones permit the air to escape through the nostril, thus defeating all attempts made to inflate. This is particularly true in adults, as the nostrils are often extremely large.

The method of procedure is as follows: One end of the auscultation tube is placed in the ear of the patient and the other end in that of the one inflating. The nose piece of the Politzer bag is now gently but securely placed in the nostril of the side which it is intended to inflate and the nose seized between the thumb and forefinger of the left hand in such a manner as to compress the free nostril and at the same time hold the nose piece firmly in position. The patient is now instructed to say such a word as "hick" or "hack," or any word

ending in "k," or to swallow a sip of water which he has previously taken into his mouth; or he may blow out the cheeks, forcing the air out through the partly compressed lips. There must be considerable force to the current of air—mere bulging of the cheeks is not sufficient. At the same time (whichever method is adopted) pressure is made on the air bag, and the air thus forced in, finding no external exit, passes on up through the Eustachian tube into the middle ear. There is no

Fig. 81. Politzerization, showing Auscultation Tube, Politzer Bag, Position of Fingers.

danger of too much air entering the middle ear as the resistance of the soft palate is easily overcome and the excess air passes out through the mouth. The crying of little children answers the same purpose as saying the word "hick," or swallowing the water. Placing the finger firmly against the tragus of the ear not to be inflated will often assist in the inflation of the one desired. If too much noise is not produced the impact of the air against the drum membrane may be heard through the auscultation tube. Compressed air is perhaps better than the Politzer bag, and is much used. The normal sound

is a soft blowing one; while in the presence of a small perforation or a much constricted tube one obtains a whistling sound. Where mucus is present râles are heard; and a harsh, rough tone indicates a dry catarrh. Success in inflating is usually indicated by a peculiar, hollow, explosive tone emitted by the patient as the resistance of the soft palate is overcome. The patient's statement as to the entrance of air into the middle ear is not always reliable. A little child usually holds its hand up to the ear when the inflation is successful. Various disagreeable symptoms may be excited by inflation. The patient may complain of pain in the head, dizziness, sensation of fulness, and impaired hearing. All of these symptoms are usually relieved by directing him to swallow a number of times, or by rapidly oscillating the tragus with the finger. Introducing the little finger into the ear and moving it rapidly back and forth also often relieves them. This is a very common practice with some people for the relief of fulness in the ear, and is quite familiar to everyone. One other disagreeable occurrence in connection with inflation is the swallowing of air. This is as a rule quickly relieved by belching.

Having completed the inflation the nose piece should be removed from the nostril and wiped off before releasing pressure on the bag, otherwise secretions may be drawn up into the tube. It is well to empty the bag once or twice before using it, in order to be certain that no secretion or fluid is present in the nose piece or tube.

Catheterization

This is the ideal method of inflating the ear, but it is rather a difficult procedure and should only be done by the surgeon himself. It consists in the passing of a Eustachian catheter back through the nose in such a manner that the tip of the catheter fits in the mouth of the tube. Air is now forced into the trumpet-like expansion of the catheter and passes directly into the middle ear. One must be more or less familiar with the nose in order to perform this operation successfully.

Nose. Before performing catheterization one should satisfy himself that there is no nasal obstruction present which would interfere with a comparatively easy passage of the catheter. Simple intumescence of the nasal mucous membranes

can be overcome by spraying them with a ¼ per cent solution of cocain, the effect of which is evident in from five to ten minutes. It is also quite frequently necessary to resort to the use of cocain in very sensitive subjects even though no nasal obstruction exists. In case one side is occluded by a deflected septum, spur, large turbinate body, or some other abnormality, the catheter may be introduced through the opposite side, or even through the naso-pharynx by way of the mouth. This latter method is so seldom used that it will not be described here. Where it is found impossible to reach the mouth of the Eustachian tube in any way at all owing to existing conditions, operative measures must, of course, be resorted to for the relief of the obstruction.

Inflating bag. The Politzer bag, with the tip pointing backward, should be held underneath the left arm so that it may be within reach and easily grasped by the right hand. In place of the ordinary olive-shaped tip used for Politzerization, there should be a special tip made to fit in the funnel of the catheter. When using the simple Politzer bag without the tube and special tip, the position of the catheter will be disturbed and cause much discomfort if not pain. The tip of the catheter may also be dislodged.

The Lucae device, which has an additional bulb, has some advantages over the Politzer bag, since the impulse of the hand is not transmitted to the catheter when pressure is made; nor is it necessary to break the connection between it and the catheter each time air is forced through it, as is the case when the Politzer bag has no valve. It can be attached to one of the buttonholes on the coat by a little hook provided for that purpose.

When using compressed air the tube can be held by the patient or laid across his lap. Inflation by compressed air is by far the most satisfactory method and has many superior advantages. It is very simply manipulated; the position of the catheter is not so easily disturbed; the air pressure is always uniform; and it is always at hand. About thirty pounds' pressure is required for successful inflation. The force should never be greater than this, as damage might result. In any case the

orifice of the catheter should not be wholly occluded as there is always the possibility of producing an emphysema through abrasions of the mucous membrane.

Auscultation tube. In catheterization, the auscultation tube is a very necessary adjunct, as it is the only certain means of knowing whether air has actually entered the middle ear or not. Its application has been described above.

Fig. 82. Eustachian Catheter.

Catheter. A No. 1 German silver catheter, which can be bent to suit all requirements, should be sterilized by immersing it in a 90 per cent solution of carbolic acid in glycerine, and thoroughly rinsing it off with sterile water. Before using it a current of air should be passed through it several times in order to remove any remaining drop of the acid, or possible obstruction. As to the curve of the tip, this will depend somewhat upon the width of the face, whether very broad or unusually narrow; or upon whether the catheter is to be passed to the Eustachian tube of the corresponding side, or to that of the opposite side. The ordinary curve forms an angle of about 135

degrees with the body of the catheter, although it may be necessary to slightly alter this angle several times before being able to enter the mouth of the tube. In passing it to the opposite side, the curve must be proportionately longer. To avoid the necessity of frequent bending, several catheters with different degrees of curvature may be prepared. A little ring on the side of the funnel-shaped extremity indicates the direction of the tip.

Use of the Catheter. While there are various methods of

Fig. 83. Introducing Eustachian Catheter—First Position.

finding the mouth of the Eustachian tube only the one most commonly used, viz., the Politzer method, will be described.

Whether one sits or stands is altogether a matter of personal taste, although the patient is, of course, seated.

Having made all preliminary preparations, such as opening the nasal passage, inserting the auscultation tube, and placing the Politzer bag or other source of air force in the most accessible position, the catheter is now passed as described below. The right ear is to be inflated. The fingers of the left hand are rested against the forehead and the left side of the nose, the tip of which is elevated by the thumb of the left hand. The catheter is held loosely in the upright position between the first finger and thumb of the right hand with the concavity of the

curve pointing toward the patient. The tip is now introduced into the right nostril and made to touch the floor of the inferior meatus by elevating the end of the catheter which is held be-

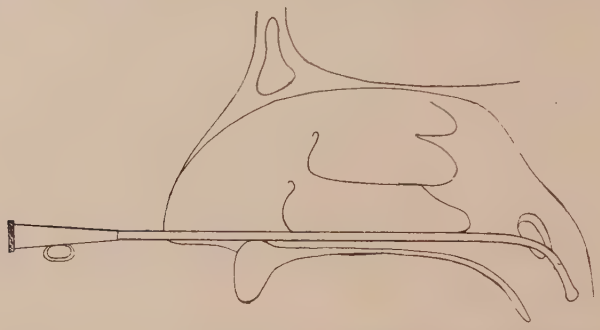

Fig. 84. Introducing Eustachian Catheter—Second Position.

tween the fingers. It is then pushed straight back along the floor of the nose, with which it must be kept constantly in contact, until it reaches the posterior wall of the naso-pharynx—that is, until it can go no farther. Upon rotating the catheter

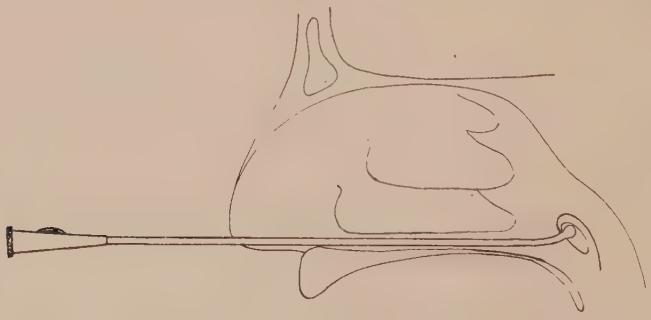

Fig. 85. Introducing Eustachian Catheter—In Position.

to the left, its tip is turned upward until the little ring lies horizontally, when it becomes lodged in Rosenmüller's fossa. This is a shallow depression just behind the opening of the Eustachian tube, having as its anterior boundary the prominent cartilaginous posterior border of the tube. As long as the catheter is maintained in a position at right angles to the face its tip is certainly in the inferior meatus, whereas if it points upward it has entered the middle meatus, and all efforts at

reaching the Eustachian orifice will be futile. Upon withdrawing the catheter a little with slight pressure on the exposed end made toward the septum, its tip is felt to slip over the cartilaginous border and into the mouth of the tube. It is held in this position by grasping it between the thumb and index finger of the left hand, the remaining fingers being allowed to remain in position against the forehead and side of the nose. By directing the patient to swallow, one should feel a tugging sensation against the catheter, which is a certain indication that it is in place. The special tip attached to the tubing of the inflating bag is now gently introduced into the funnel-shaped end of the catheter, and several successive pressures made on the bag just as in Politzerization. In using the Politzer bag without a valve, the tip should be disconnected from the catheter each time before the hand pressure is released. This is not necessary when using the Lucae bag or compressed air.

In passing the catheter through the opposite side of the nose the steps are practically the same, except that when the posterior wall of the naso-pharynx is reached the tip is rotated in the opposite direction, so that the little ring points to the side which it is intended to inflate.

The catheter is disengaged from the mouth of the tube by rotating it in a direction opposite to that from which it was rotated when made to enter the fossa of Rosenmüller. When catheterizing the right ear, for instance, it is rotated to the left. It now points downward in the naso-pharynx, as is indicated by the direction of the ring, and can be easily withdrawn by following the same course used in its introduction. There is occasionally a drop of blood on the tip, which is of no particular significance except that it may alarm the patient. It indicates either that the catheter was not in proper position, or that the mucous membrane surrounding the tube is inflamed.

The indications for catheterization are practically the same as for Politzerization. It is merely a different way of introducing air into the middle ear. It is, however, much more accurate in its application, as the current of air can be applied to one ear at a time with absolute certainty, whereas in Politzerization both ears are often inflated simultaneously. The auscultation sounds are very easily heard, and it is, therefore, a better

method as a means of diagnosis. One is also not dependent upon the patient for the success of the inflation.

Further, through the catheter various remedies in solution can be made to reach the tympanic cavity. Two or three drops of the solution are placed in the funnel-shaped end of the catheter with an ordinary medicine dropper after the catheter is in position, and inflation performed in the ordinary way. It is very rarely that more than one drop reaches the tympanic cavity. There is, therefore, no cause for alarm that too much fluid will enter. The mouths of the Eustachian tubes can also be reached through the catheter when it is desired to apply remedies directly to them. A catheter with a large lumen is required—that is, one sufficiently large to admit a fine flexible applicator. Around the tip of this applicator is firmly wound a very small bit of cotton by means of which the remedy is applied. Care should be observed that the cotton is firmly wrapped about the applicator, as it would occasion considerable trouble were it to come off in situ.

The Eustachian catheter cannot be used in children nor in the presence of acute inflammation either of the nose or of the middle ear.

Massage

There are several means of performing massage of the tympanic membrane, although they all have the same end in view, viz.: the condensation and rarefaction of the air in the external auditory canal. This produces an in-and-out movement of the drum membrane and is of value where the membrane is thickened or where adhesions have taken place, or are taking place, in the tympanic cavity.

The instrument known as Siegel's otoscope answers all practical purposes, although there are many specially devised apparatuses. The accompanying illustration explains the otoscope fully. It is introduced into the external canal in the same manner that one introduces a speculum. It should be pressed into the meatus with a slight rotatory motion but not introduced so far as to give rise to discomfort. It is best to provide the metal tip with a little section of rubber tubing, in order to avoid injuring the canal walls. A piece of tubing one-half inch long will answer the purpose. In order to have

the external meatus hermetically sealed it is sometimes necessary to wind a pledget of cotton around the part inserted. If the air escapes this is an indication that the speculum is not fitting snugly. No sound should be heard. Before the introduction of the otoscope a little of the air should be expressed from the bulb, and when it is in place the bulb should be alternately compressed and released. Sixty times a minute is quite sufficient, and sittings of five minutes duration are usually all that

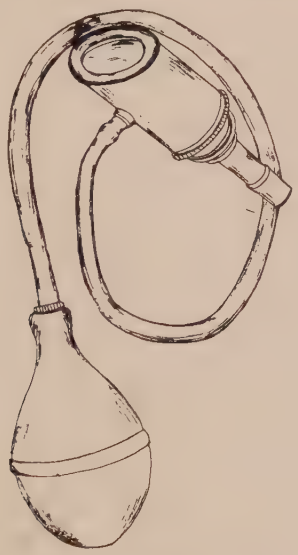

Fig. 86. Siegel's Otoscope.

is necessary. Do not massage too vigorously, nor more than once a day at the most.

Electric massage is accomplished by placing in the ear an appropriate ear tip connected with one end of a rubber tube, the other end of which is attached to a suction pump operated by an electric motor. It has no particular advantage over the other method other than it is more easily manipulated. After the procedure is over the drum membrane will be found to be injected along the handle of the malleus. This is of no particular significance, and the injection soon passes away.

Suction

This is also sometimes employed in the external canal. It

is used for the purpose of drawing out secretions, inaccessible to other means. It is particularly useful in withdrawing secretions from the mastoid cells, or Eustachian tube. It may be accomplished by the use of the otoscope described above, as for instance by expelling all the air possible from the bulb and allowing it to fill up while the instrument is in place in the ear, or by use of a Politzer bag provided with a suitable ear piece which hermetically seals the external meatus; the air is expelled from the bag before the tip is introduced. Suction may also be performed with an ordinary barrel and piston syringe also provided with a suitable tip for introduction into the canal. Whatever method is used the prerequisite to success is that the canal be absolutely airtight and a vacuum formed in the instrument used.

Local Abstraction. Blood Letting

This is indicated in the early stages of acute inflammation; that is, before the expiration of forty-eight hours. It is also useful in furunculosis, but should not be resorted to if the parts are greatly inflamed and very tender. It is of no benefit in the suppurative stage.

Blood letting is accomplished by the leech (natural and artificial). These have been described in the section on Eye and the method of using them does not differ materially except as to the place of application. In inflammations of the external canal and the drum membrane, the leeches are applied over the tragus; for inflammations of the deeper structures and of the mastoid they are applied near the tip of the mastoid process. In adults it is usually necessary to apply two or three, but in children one is quite sufficient. Particular care must be observed that the external canal be plugged firmly with cotton, in order that the leech may not gain entrance. Anesthesia may be secured by the use of a cotton pledget saturated with carbolic acid 10 per cent in glycerine applied about ten minutes preceding the application of the leech. It is perhaps best to scarify the point of application in order that the leech may take hold at the spot desired. In the presence of purulent discharge from the ear the field must be thoroughly sterilized before the application, and following it an occlusive dressing should be placed over the bleeding point in order to prevent

infection. In addition to the above, heat may be applied by means of the Leiter coil, although this apparatus is better adapted to the application of cold.

Heat and Cold

Heat. For the application of *dry heat* the ordinary hot water bag is very serviceable, the patient simply resting his head against it in the position most comfortable to him.

An old fashioned salt or bran bag is also serviceable. This should be about six inches square and filled with sufficient salt or bran to make it about one-half inch thick. It is a mistake to have either it or the hot water bag filled completely, as it is hard and uncomfortable. It is placed in an oven, or on a

Fig. 87. Japanese Pocket Stove.

tin plate on the stove until it becomes quite warm, and is used in the same manner as the hot water bag. Being light, it may be held in place by a bandage while the patient is in the upright position. In all instances, however, it is best to have a piece of flannel or cloth intervening between the bag and the skin. A large flat bottle filled with hot water can also be used, but it is hard and uncomfortable. There is made the so-called Japanese pocket stove which can be wrapped in flannel and used as the others. This stove consists of a little box with a sliding cover. In the box is placed a little packet of pulverized carbon ignited at one end—after which the lid is closed. This can also be fixed to the region about the ear with a few turns of bandage. For insertion into the canal of the ear little improvised salt bags have been suggested. These are made from the fingers of old gloves. The little finger of the glove is, for instance, filled with salt and placed in the oven until it attains

the proper temperature when it is inserted as far as possible into the canal of the ear. It is held in place by a light bandage, or remains in position if the patient lie on the opposite side.

For the application of *moist heat* there are various means, some of which have already been described in the section on Eye. This applies particularly to the application of hot fomentations. For this purpose there is used a basin containing water kept constantly at a temperature of 102° F. by means of an alcohol lamp, radiator, or stove. A large thick cloth folded several times is dipped into the water, wrung out, and applied over the auricle for five or ten minutes, alternating every second or two with a similar cloth held in readiness so that the change may be quickly made. This may be repeated every hour or two as necessity demands. Or, if constant moist heat is required, the cloth may be protected by a piece of oiled silk or gutta percha tissue, and held in place by a bandage. Some of the water will no doubt enter the external canal, and this should be dried out with a cotton-tipped applicator after each sitting. There is not so much danger of the water entering the external canal if the patient hold his head sideways over the pan while making the application. Water at a temperature of 102° F. may be poured into the canal with a teaspoon, but never directly from the spoon in which it has been heated over a flame. The patient lies on the opposite side, and a cloth must be held around the auricle in order that the water may not trickle down his neck. An antiseptic may be dissolved in the water if desired, but pratically all the virtue lies in the heat itself. This may be resorted to every few minutes for one-half hour, each time allowing the water to run out, by holding the head toward the affected side, before making the next application. The canal should be dried at the end of each sitting. The procedure may be repeated every two or three hours, or oftener if required.

Water of the same temperature may also be applied to the external canal by means of the continuous stream. For this purpose the ordinary fountain syringe may be used. This should be held not more than three or four inches above the level of the ear in order to avoid undue force of the stream.

Care must be observed that the canal be not occluded in such a way as to prevent the return flow. An irrigating basin must be placed under the auricle just as when syringing. The procedure can be carried out with the patient in either the upright or the recumbent position. A quart of water may be used, and the irrigation repeated every three or four hours. In place of the fountain syringe an ordinary syphon tube may be employed. This consists in an ordinary rubber tube as long as necessary. One end of it is placed in the vessel containing the water, which is raised a few inches above the level of the ear, and the other end is placed in the mouth. The water begins to flow when suction is made. Or the canal may be gently syringed out with the barrel and piston or soft rubber ear syringe as before mentioned.

In addition to the above, steam is sometimes introduced into the canal, although this is rather a dangerous procedure. It often causes burning of the skin. If resorted to at all the parts should be previously smeared with vaseline. This holds good, in fact, in the case of all moist heat applications, provided the skin be very delicate. For the application of steam, a pint of actively boiling water is required, or the steam direct from the tea kettle may be used. A large cone is formed with paper, the small end inserted into the canal of the ear and the large end made to cover the pan or the mouth of the tea kettle. The steam is thus allowed to enter the canal, and relieves pain by virtue of the heat just as in the other methods. This may be continued for five or ten minutes at intervals of one to four hours, according to necessity.

Poultices are mentioned more to warn against their use, as they tend to promote suppuration and act injuriously on the soft tissues. They also become extremely uncomfortable because of evaporation of the water in them. Any prolonged use is particularly contraindicated because of the injurious influence upon the deeper structures of the ear. This is more or less true of all moist applications. The only poultice having any real virtue is perhaps the conical poultice which is so formed as to fit the concha and outer part of the external canal. Ordinary linseed meal is used in the preparation of this poultice, being formed into a thin paste and placed in cheese-cloth made into

the shape of a cone which just fits the parts. It may be held in place by a bandage and should be changed frequently because of the discomfort it produces when it dries out. This it does very quickly, owing to its small size.

Cold. This is especially indicated in the early stages of acute mastoid inflammation for the purpose of aborting the attack, if possible. Dry heat is preferred by many in such cases. Cold may be applied in the form of compresses as described in the section on Eye. In this case, however, the compresses are formed in the shape of a horse-shoe and made to surround the auricle. They should be changed every few minutes and applied for periods of ten or fifteen minutes every

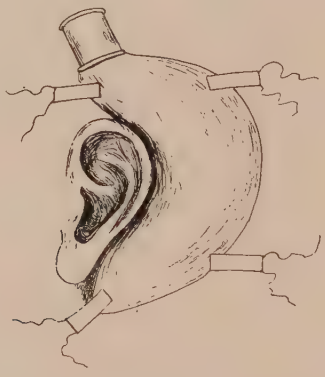

Fig. 88. Mastoid Ice Bag.

hour or two as required. It is best to plug the external canal with cotton in order to prevent any of the cold water trickling into it. This is not only very uncomfortable, but often injurious as well. The temperature of the water should be about 45° F.

Cold may also be applied satisfactorily by means of the ice bag. Either the ordinary ice bag, or better still a specially devised auricular or mastoid ice bag. These are made as right and left, and in such a manner as to allow them to fit around the auricle. The bag is filled about one-third full of crushed ice, care being taken that no large pieces or sharp corners be present. A moderately thick compress should be placed between the bag and the skin, its thickness depending upon the amount

of protection the part requires, or whether extreme or moderate cold be desired.

The Leiter coil is one of the best means for the application of cold to the ear. This should never be applied for more than forty-eight hours; and twelve hours of continuous application is usually sufficient. Even during this period it is best to interrupt its application for a few minutes at a time in order that important symptoms be not masked. The coil consists in a thin lead tube bent two or three times on itself and attached to a thin lead plate with suitable slits above and below for the reception of tapes which hold it in place. A bandage may also be applied over the whole. To one end of this bent tube is

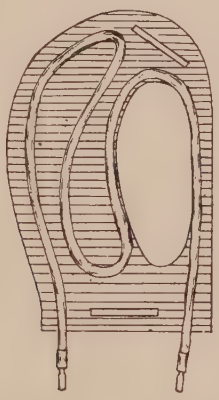

Fig. 89. Leiter Coil.

attached a rubber hose of small caliber which communicates with a vessel containing ice water. A large irrigating jar is perhaps the best, although a fountain syringe will answer. This latter has the disadvantage of requiring that the ice water be prepared before being introduced, whereas in using the irrigator the ice itself can be placed in the apparatus. The vessel containing the ice water is placed just far enough above the level of the patient's head to permit of a slow movement of the stream through the coil. The water passes out through another rubber tube attached to the other end of the lead tube and into a suitable receptacle. This should be placed on the floor near the bed. The water can be used repeatedly so long as it is kept at the proper temperature. There is likely to be considerable

condensation of water on the outside of the lead tubing. This is caught up by the compress introduced between the coil and the skin, and this compress should be changed when it becomes saturated.

CHAPTER X.

COMMONER DISEASES, SYMPTOMS, DANGER SIGNALS.

Cerumen

There is normally present in the canal of the ear but a small quantity of thin, soft, yellowish wax or cerumen of which one should not be conscious. The presence of large quantities of wax is an evidence of irritation of the canal wall, or of some abnormal condition within the middle ear. The removal of the cerumen normally present is attended to by Nature in that the movements of the jaw are communicated to the cartilaginous portion of the canal, and the wax is thus forced out. The use of instruments in the ear for the removal of cerumen is dangerous unless one is skilled in such manipulations. Syringing is always the most satisfactory and also the safest method. The mass of cerumen occupies the canal of the ear either completely or partially. As long as the lumen is still patulous hearing is not materially affected. The wax developes slowly until but a small lumen remains and then this suddenly closes, perhaps from the entrance of a little water which causes the cerumen to swell. The consistency of the cerumen varies. It may be soft and pliable or so hard that it is almost impossible to make an impression on it with an instrument. It may also be adherent to the walls of the canal and leave a bleeding surface when removed. Before its removal it may be necessary to partially break it up, or to dissolve it by the use of a 4 per cent solution of sodium bicarbonate in equal parts of water and glycerine. The method has already been described. Cerumen may be confused with dry collections of purulent secretion, or with foreign bodies which have become coated over with it.

Foreign Bodies

There are two varieties of foreign bodies which may accidentally enter the ear or be introduced intentionally. First, are those which are capable of swelling, such as, for instance, peas, beans, paper-wads, cork, etc., etc.; and second, an end-

less list of such things as beads, buttons, cherry stones, matches, tooth-picks, etc., as well as insects, not capable of swelling. Although many of the things enumerated find their way into the ear accidentally, they are as a rule intentionally introduced by children and the insane. If a foreign body is capable of swelling or is so firmly impacted as to give rise to considerable irritation it should be removed as soon as possible; if it is not firmly impacted or not capable of swelling it may remain in the canal for years without exciting any symptoms other than impaired hearing. An exception to this is, of course, live insects, which should be removed immediately. There is, therefore, no urgent necessity for the immediate removal of innocent foreign

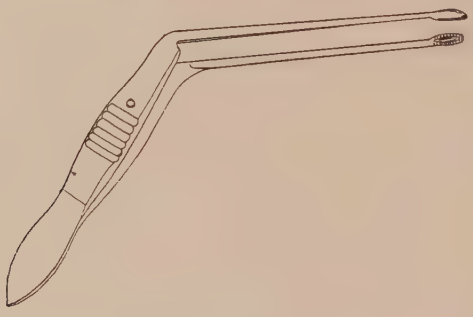

Fig. 90. Aural Pincette.

bodies, and familiarity with this fact may prevent much serious damage from being done by hasty and awkward efforts at removal. No attempt should be made to remove a foreign body with instruments until the simpler methods have been tried. But first of all is there a foreign body present? It may have fallen out, or it may not have entered at all. Very frequently a foreign body lying loosely in the canal of the ear will fall out of its own accord if the head be inclined to the affected side, the auricle pulled upward and backward, and the jaw opened and closed a few times. If this does not succeed, simple irrigation with warm sterile water may be resorted to and is almost always successful. In the case of live insects filling the canal with warm water or oil will be sufficient to kill them, and they can be subsequently removed by gentle syringing. Blowing smoke into the canal is also effective; or pouring chloroform

vapor into the ear, as later described, can be resorted to. Leeches are removed by irrigating with a normal salt solution, although their entrance into the canal is of very rare occurence. If the foreign body be impacted, syringing is of little value and an instrument must be used. This may be either an aural pincette or a little foreign body hook. Care must be used when employing the hook for fear of its catching in the wall of the canal should the patient move his head. The field should be well illuminated, as otherwise much damage might be done. In the use of an instrument coöperation of the patient is absolutely necessary, and general anesthesia must often be used. Care must be taken not to mistake a polypus for a foreign

Fig. 91. Foreign Body Hook.

body, as it will not come out by syringing, and removing it with a forceps might cause troublesome bleeding. They sometimes grow to such proportions as to protrude from the external meatus. If the foreign body remains in the canal for some length of time it will probably be coated over with cerumen, and this point must be kept in mind when determining the nature of it.

Furunculosis

This is an extremely painful affection of the external canal, and is very apt to be protracted in its course. They usually occur in crops, just as on the back of the neck, and are very recurrent. Inspection of the canal usually shows a point of inflammation which is most frequently found on the walls of the cartilaginous portion, although it may be situated deep

down in the osseous portion. In this later location the pain is much more intense. The pain accompanying furunculosis of the deep portion of the canal is usually of the hammering type and is worse at night and on moving the jaw. Tinnitus, or subjective noises in the ear, are also usually present. Furunculosis of the outer portion of the canal is usually accompanied by a feeling of warmth and fulness. Pain is excited by pulling on the auricle; also by movements of the jaw. A symptom which sometimes accompanies this condition of the external canal, and can easily lead to an error in diagnosis, is swelling back of the ear over the mastoid process. Since furunculosis and mastoid inflammation are often confused it is considered advisable to append the following differential diagnosis as given in the work of Barnhill and Wales:

FURUNCULOSIS.	MASTOIDITIS.
Pain. Always present and severe.	Often present. Not always severe.
Aural discharge. Infrequent and scanty.	Present in nearly every case. Often profuse.
History. Exceptionally preceded by exanthematous diseases, throat affection, or middle ear abscess.	Usually preceded by exanthemata, la grippe, throat affection, and nearly always by middle ear abscess.
Post-auricular swelling. May be present.	May be present.
Tumefaction within auditory meatus. Is present in outer two-thirds of canal, and may occur on anterior, inferior, or posterior portion of canal wall.	Is present at fundus of canal, and only in one situation, namely, the postero-superior canal wall.
Pain on moving auricle. Very severe.	None.
Pain on pressure over mastoid. Absent unless the auricle is moved or touched during the manipulation.	Present at tip, over site of mastoid antrum, and sometimes over whole mastoid area.

In the treatment of furunculosis the affection may sometimes be aborted in its incipiency by the application to the canal walls of a 2 per cent ointment of yellow oxide of mercury applied on a cotton cone or plug. For the relief of pain the application of hot compresses sprinkled with laudanum or

chloroform liniment and protected by rubber tissue is sometimes effective. Early incision is the treatment par excellence.

Injuries

Injuries to the auricle itself belong in the domain of surgery and general surgical rules apply. Frost bites of the auricle are of course of common occurence in winter, and all are familiar with their treatment—that is, the immediate application of cold, and the subsequent application of gradual warmth. The immediate application of heat is advocated by some authors. In the desquamative stage the part is protected with pledgets of lint moistened with some bland ointment. For contused wounds of the auricle cold compresses are indicated. Burns of the auricle and the skin surrounding it are treated by the application of zinc or lead ointments on pledgets of lint, these being in turn covered by cotton and held in place by a roller bandage. Under no circumstances place cotton next to the raw surface. If the pain be severe a small quantity of extract of opium may be added to the ointment, or a 2. per cent cocain ointment may be used. Where the skin immediately behind the auricle is involved care should be taken that the two surfaces be separated by a pledget of cotton moistened in the ointment, in order to avoid the formation of adhesions. In case the burn has been produced by a caustic solution a proper neutralizing agent should be used. If an alkali, use vinegar; if an acid, use sodium bicarbonate. Burns by scalding are treated just as those from other causes. Should the caustic solution have entered the canal of the ear this must of course be syringed out with the proper neutralizing solution, and a plug of cotton anointed with an appropriate salve introduced. This latter is for the purpose of preventing adhesions between the walls of the canal, and for the relief of pain, if necessary.

Impetigo and Eczema

This condition of the skin of the auricle and the region immediately surounding it consists in the formation of crusts and scabs upon an inflammatory base. It is usually due to neglect in cleansing the canal of irritating secretions which are allowed to flow out onto the surrounding skin. It is found most frequently among dispensary patients and those of the

lower classes. The area involved is sometimes so extensive as to include the whole side of the head. It is not to be confounded with an ordinary eczema, which may be excited by constant moisture of the parts resulting from syringing or too prolonged use of moist compresses. In cases predisposed to eczematous eruptions the dry treatment is indicated.

In the treatment of this condition it is first necessary to dissolve the crusts and scabs and expose the inflamed base. This is done by the application of a bland oil or ointment, pure castor oil or simple sweet oil answering the purpose. The surface may be painted with liquid vaseline by means of a camel's-hair brush or an applicator wrapped with cotton. Or compresses of lint soaked in the oil may be applied to the parts and allowed to remain over night. They are best held in position by a roller bandage. This is, of course, impractical in the presence of profuse discharge. In the case of simple impetigo this will usually clear up without any particular medication when the exciting cause is removed—that is, the discharge from the ear. Moist weeping surfaces are best treated by the application of powders; dry, scaly conditions by the application of ointments.

Acute Otitis Media

This condition may be of the catarrhal or suppurative type. The symptoms are very much the same in either case except that in the latter they are usually more severe, and constitutional symptoms such as rise in temperature and general prostration also develop. The suppurative type usually terminates in rupture of the drum membrane, and evacuation of the pus, while in the catarrhal type the secretion is usually absorbed.

Otitis media is almost invariably due to extension of some process from the nose or throat, and consists in swelling of the mucous membrane lining the drum, and the presence of exudation, either serous, mucous or purulent. The most prominent and pronounced symptom is earache, beginning as a sensation of heat, fulness, and pressure, which soon becomes deep-seated and intense. As the inflammation advances the pain assumes a lancinating and tearing character. It is usually worse at night when the patient is in the recumbent position; sleep is

impossible. The pain is markedly exaggerated by coughing, sneezing, blowing the nose or swallowing, and may radiate over the temporal region on the affected side. It may also be felt in the teeth. Traction on the auricle does not excite pain. The hearing is greatly impaired and all varieties of subjective noises may be complained of. The administration of opiates for the relief of pain is not advisable, as they might mask important symptoms. Incision of the drum membrane is usually resorted to if abortive measures fail to give relief after from twenty-four to forty-eight hours.

Chronic Catarrhal Otitis Media

This condition is usually due to extension to the middle ear of catarrhal processes in the nose and throat. It may follow an acute attack or develop insidiously, resulting in thickening of the mucous membrane, lining the middle ear, and the formation of connective tissue. Pain is rarely complained of. Tinnitus aurium—that is, subjective sounds—is almost always present, and sometimes to such a degree as to threaten the patient's mental balance. The hearing becomes impaired early in the course of the affection, although at first only at intervals. Relief is not usually sought until the periods of good hearing become gradually shorter. Examination in the early stages usually shows no change in the drum membrane except possibly a slight injection of the vessels along the handle of the malleus. It should be remembered that this injection may also be due to the irritation produced by the speculum. As the disease progresses the membrane assumes a dull gray color, and the handle of the malleus is drawn inward so that it has the appearance of being much shorter than normal. The membrane is said to be retracted. This retraction often becomes so extreme as to cause the membrane to lie against the bony inner wall of the tympanic cavity. Chalk deposits are frequently seen. They are of a dense white color, very frequently crescentic in outline, with a sharp limiting border, and seem to form part of the membrane. If the affection is discovered in the early stages and is dependent upon conditions in the naso-pharynx, some benefit can be hoped for through the institution of appropriate treatment. After the age of thirty, however, very little improvement can be

expected, although it is often possible to check the progress of the affection. The technique of the various methods of treatment have been considered under their respective heads—for instance, massage, local applications, paracentesis in the presence of fluid, inflation, etc. A consideration of conditions of the naso-pharynx such as adenoids and tonsils is not within the domain of this book.

Chronic Purulent Otitis Media

This condition follows an acute inflammation of the middle ear whether catarrhal in nature, with secondary infection, or primarily purulent. It is usually considered chronic if it has continued for two or three months. While the condition may persist for years without any serious consequences it is impossible to say just when mastoid or cerebral involvement may take place. It is, therefore, of quite serious import. Reasonably good hearing can be retained, even in the presence of extensive perforations, or total loss of the drum membrane, so long as the mobility of the stapes is not interfered with.

Upon inspection, the canal is found to contain a variable quantity of usually foul-smelling purulent discharge. When this is removed with a cotton tipped applicator, the membrane is found to be perforated, and usually in the posterior quadrant. The size of the perforation is extremely variable. A perforation in the flaccid or upper portion of the membrane (Shrapnell's membrane) is also very commonly found. The discharge is often intermittent, sometimes ceasing altogether for weeks or months. Polypi and granulations are often found protruding through the perforation. They may even be so large and abundant as to fill the external canal. Pain is seldom experienced, except in the presence of complications, and subjective noises are rarely heard. Sudden dizziness, nausea and profound deafness are characteristic of involvement of the labyrinth, although extreme dizziness and perhaps nausea may be excited by syringing. Mastoid involvement is usually indicated by marked diminution or cessation of the discharge with accompanying pain and tenderness over the mastoid region.

Owing to the peculiar construction of the ear, and the inaccessibility of its various parts to local treatment, chronic purulent otitis media is naturally very stubborn and rebellious to

treatment other than that of a radical operative nature. As in the case of chronic catarrhal otitis media, those measures ordinarily used in treatment, such as syringing, drying, introduction of drops, etc., have been considered in another chapter of this section.

Common Symptoms of Ear Affections

Sudden Loss of Hearing. Among the more common causes may be mentioned the entrance into the canal of a foreign body, complete occlusion of the canal by the swelling of cerumen, stoppage of the Eustachian tube, and, finally, the extravasation of blood or serum into the tympanic cavity or internal ear.

Fulness. This is usually due to closure of the Eustachian tube, and frequently occurs after inflation. In this case it is as a rule relieved by swallowing or by making quick oscillatory movements of the tragus as described before. It may also be due to the presence of secretion in the tympanic cavity.

Giddiness. This may be due simply to pressure of wax on the drum membrane, or the presence of a foreign body. It also often follows inflation and irrigation.

Tinnitus Aurium. Subjective noises are the most annoying and sometimes the most obstinate to treatment of all symptoms associated with the ear. They may be absent in grave conditions, and present where there is apparently not the slightest cause for them. All varieties of noises are complained of by the patient, as, for instance, hissing, bubbling, crackling, humming, pumping, throbbing, and an endless variety too numerous to be mentioned. Some are very characteristic of certain conditions, while others seem to have no association whatever. Catarrhal conditions of the lining mucous membrane of the ear are perhaps the most common cause.

Pain. This may be of inflammatory or reflex origin. Under the later heading may be mentioned that referred to the ear from carious teeth, tonsillitis, rheumatism involving the articulation of the lower jaw, neuralgia, stoppage of the Eustachian tube, etc. Such pain is usually intermittent and may recur for weeks or months without further developments. Under the heading of inflammatory pain may be mentioned

that dependent upon conditions in the external canal, tympanic cavity, or mastoid cells.

Temperature and Pulse. There is a rise in temperature and a corresponding acceleration of pulse in almost all purulent affections of the ear, although it is so variable that no definite degree can be mentioned. In children it is quite frequently accompanied by delirium, convulsions, and even coma.

Cerebral Involvement. If the temperature is accompanied by rigors and the following group of symptoms, cerebral involvement can usually be diagnosed, viz.: headache, vomiting, restlessness, slow cerebration, emaciation, and delirium. Many of these symptoms may be exhibited in cases of acute suppurative inflammation of the middle ear in children, but one is almost certainly justified in diagnosing cerebral involvement when they are present as a group.

Hemorrhage. This occurs from the ear as a result of injury to the external canal, rupture of the drum membrane, fractured skull, vicarious menstruation, polypi and unhealthy granulations, as well as from carious bone. In this latter case the hemorrhage may be even fatal as a result of erosion of the walls of the carotid or jugular vein which are in intimate relationship with the ear.

Suppuration. This is almost invariably due to purulent conditions in the tympanic cavity or in the mastoid cells. It may be due to abscess of the external canal. It might amount to nothing more than mere moisture in the canal, or it might be so copious as to flow out over the side of the neck and require removal every hour or two by irrigation or drying. In the fresh state it has no odor, but in old chronic cases, particularly in the presence of diseased bone or cheesy degeneration of the pus, the odor is foul and nauseating.

Danger Signals

It is quite important that one be familiar with certain symptoms owing to the necessity of immediate skilled attention. Many of these have been considered in another section, but owing to their extreme importance a repetition of some of them will not be out of place.

Pain. Pain in the ear should be considered a danger signal. It may be of only slight significance, but, on the other

hand, it may be of very serious import, and be associated with some condition which might result in permanent loss of hearing were it neglected. The cause of an earache should be recognized and removed as soon as possible. Persistent, severe, unilateral headache over the side of the affected ear should also be looked upon with suspicion. Pain on pressure over the mastoid is also a danger signal. In chronic purulent conditions, intense pain of sudden onset, persistent, and extending to the side and back of the head may mean cerebral abscess or intracranial involvement, particularly if accompanied by pallor, cold sweats, nausea and vomiting, stupor, delirium and coma.

Convulsions. These are always an alarming symptom when associated with ear diseases, although they occur quite frequently in little children where no cerebral involvement is present. Other dangerous symptoms are almost always present.

Discharging Ears. A running ear is always a danger signal, for one never knows just when the suppurative process will reach some structure with fatal results. Sudden cessation of discharge from an ear which has been flowing freely indicates obstructed drainage or deeper involvement.

Temperature. Increase in temperature and restlessness at night, particularly if accompanied by cessation of discharge, may also indicate obstructed drainage or deeper involvement Persistent low temperature accompanied by constant headache and listlessness which is progressive is a quite characteristic symptom of brain abscess. Continued high temperature is usually an indication of insufficient drainage. Sudden elevation of temperature to 104° to 105° F., which persists a few hours and then suddenly and spontaneously falls several times a day with accompanying profuse perspiration, is quite characteristic of involvement of the sigmoid sinus.

Hemorrhage. Copious hemorrhage from the canal, persistent and difficult to control, usually indicates erosion of the walls of the carotid artery or jugular vein.

Twitching. Twitching of the facial muscles usually indicates irritation of the facial nerve; and a blank expression of the face on the side corresponding to that of the affected ear, with inability to raise the eyebrows, close the lid, or elevate the

corners of the mouth, indicates facial paralysis from injury, operative or otherwise, or some pathological condition which has involved the facial nerve.

Swelling. Edematous swelling over the mastoid region usually indicates that the pus has ruptured through the bony cortex of the mastoid process and collected under the skin. This swelling may also be due to inflammation of the external canal, as was before mentioned.

Watery Discharge. Profuse watery discharge from the ear following injury often indicates fracture of the skull, although the mucous membrane of the tympanic cavity is capable of secreting an astonishingly large amount of serous fluid. This should be taken into account before jumping at conclusions.

Systemic Infection. Pallor, feeble pulse, mental apathy, and gradual loss of strength are indications of systemic infection, and are usually signs of a fatal termination.

Meningitis. Diffuse meningitis is indicated by such symptoms as intense headache, photophobia, persistent high temperature, nausea and vomiting, and rigidity of the muscles of the neck.

CHAPTER XI.

OPERATIONS—MASTOID DISEASE.

Operations

Preparation of the External Canal. If secretions or wax be present in the external canal these should be syringed out with plain sterile water of the proper temperature, and the walls of the canal dried with cotton on an applicator. The canal is again syringed out with a 1-5000 solution of bichloride, followed by sterile water, as the bichloride solution may be irritating and may in fact even cause pain. To insure greater asepsis the walls of the canal may be swabbed with a cotton-tipped applicator dipped in the bichloride solution. The meatus is now plugged with a piece of sterile cotton which is allowed to remain until just preceding the operation. It is then removed and the same process of cleansing repeated. In the presence of excessive secretion thorough cleansing of the canal should be carried out several times a day for four or five days preceding the operation.

Local Anesthesia.

The effect of cocain on the drum membrane, unless the surface is abraded, is practically nil. This is quite reasonable to suppose when one considers that the external layer of the drum membrane is simply a continuation of the skin of the body, and it is a familiar fact that cocain has no effect on the external skin. For anesthetizing the drum membrane a solution of equal parts of the crystals of cocain, menthol and carbolic acid dissolved in a few drops of water, is sometimes used. This is applied to the membrane by means of a cotton plug which is made to rest against the membrane. In some cases sufficient effect can be produced in a few minutes to permit of a painless operation. The hypodermic syringe with a long needle is also occasionally used, the point being inserted in the wall of the canal near the drum membrane and a 2 per cent solution of cocain injected after the method of Schleich. Spraying the

drum membrane with ethyl chloride or any freezing mixture is likely to result in dermatitis of the canal, and is not to be recommended. Another method of producing anesthesia of the drum membrane is that of Gray, of England. The canal is cleansed and dried and the patient placed in the recumbent position with the affected ear up. The canal is filled with the following solution, which is warmed: Cocain crystals gr. xii, aniline oil and absolute alcohol, of each one drachm. This is allowed to remain ten minutes, when it is permitted to run out by turning the head to the opposite side. The excess solution is gently wiped out of the canal. This solution cannot well be used in the presence of a perforated drum membrane on account of the possibility of developing toxic symptoms from absorption of the solution retained in the tympanic cavity. This is particularly apt to occur when cocain is used.

Preparation of Instruments.

These are prepared as for any other surgical operation, being boiled in a soda solution for ten or fifteen minutes. Delicate cutting instruments, however, which are used about the ear must never be allowed to remain in boiling water for more than a few seconds. The best method for the sterilization of these is as described in the section on Eye, namely, immersion in carbolic acid, either pure or prepared with glycerine in the proportion of 90 per cent of the former to 10 per cent of the latter. After having remained in this solution for a few minutes the instruments are lifted out with forceps, and placed in an instrument holder filled with moderately hot water. The amount of carbolic acid clinging to the instruments forms with the water a weak solution of the acid, which acts further in sterilizing them. Extreme care should be observed that the delicate points of the instruments do not come in contact with anything in being transferred from the acid to the instrument holder, as they are very easily injured. In sterilizing rubber specula, or any instrument of hard rubber, these may be boiled, provided they are not roughly handled before cooling. Otherwise they would be pressed out of shape, owing to the softened condition produced by the heat.

Position of the Body.

The position of the patient for operations under anesthesia is, of course, the recumbent one, but where operations are performed under local anesthesia the semi-recumbent or sitting position is the best. This is, however, optional.

Paracentesis

This is probably the most commonly performed operation in general ear practice and consists in incising the drum membrane for the release of secretions, purulent or otherwise, which

Fig. 92. Paracentesis Needle.

are present in the tympanic cavity. An ordinary cataract knife answers all purposes, although there is a special paracentesis needle. Preceding this operation the canal is prepared as above.

A U-shaped incision yields the best results. The point of the instrument used for performing the paracentesis should be inserted in the posterior segment of the drum membrane just below the posterior ligament, and the incision made to pass down and around the lower end of the malleus and up on the other side. Mere puncture of the drum membrane is of little value, owing to the rapidity with which the opening closes. It is sometimes almost impossible to make out any landmarks, and in this case a simple long incision through the apex of the bulging membrane will have to suffice.

The after treatment consists in keeping the canal clean by wiping it out with a cotton-tipper applicator either dry or

moistened with an antiseptic solution. When all the secretion has been removed the canal is thoroughly dried and the external meatus plugged with sterile absorbent cotton. This may be done several times daily, depending upon the amount of secretion. Some authors advocate the introduction of a wick of gauze which is placed loosely in the canal. For this purpose are used strips of gauze free from ravelling, two and one-half inches long and three-fourths inch wide, one end being folded into cylindrical shape. The strip is grasped with a dressing forceps three-fourths of an inch from the folded end and passed into the canal until it comes in contact with the drum membrane. Folds of the wick are now placed over one another until the canal is loosely filled, and a few folds are left lying in the concha. The canal should never be packed tightly, as this would give rise to considerable discomfort, and also prevent proper drainage. The end of the wick must be in actual contact with the drum membrane. A layer of gauze and cotton is placed over the auricle and held in position by adhesive strips or a roller bandage. The dressing of gauze and cotton takes up the discharge from the wick. This method is impracticable in the presence of much secretion, not only because of interference with proper drainage, but because of the frequent changes required. The presence of the wick in the canal is also sometimes a source of irritation. Where the discharge is almost nil this method is satisfactory in that the serous secretion which almost always follows such an operation is taken up by the wick and carried to the antiseptic compress.

In removing the wick from the external canal, this should be done very gently, as the inner end might be adherent to the wound in the tympanic membrane and its attempted removal cause pain or considerable bleeding. It may be necessary to introduce a few drops of antiseptic solution before removing the gauze. This is particularly true where a plug of cotton or gauze has been introduced into the canal after an incision in the wall in case of furunculosis, as the dressing is almost invariably adherent to the line of incision. The wick is changed daily and inserted for five or six days following the paracentesis. It may be necessary to resort to syringing in case the discharge become very profuse. If much pain follow the opera-

tion the canal may be gently irrigated with warm antiseptic solution. Where a dressing is applied to the auricle always observe the precaution to place a pad behind it in order that equal pressure may be exerted and that the two skin surfaces be not in apposition. This might give rise to impetigo, and in any case is a source of discomfort because of the unavoidable moisture. The additional pad is particularly indicated where it is desired to exert pressure for the control of hemorrhage.

A patient should remain indoors for at least one day following a paracentesis, and preferably in bed. The diet and the bowels should also be attended to.

Fusing Caustic on Applicator

Two substances may be fused on the end of an applicator for the purpose of cauterization in the ear. These are silver nitrate and chromic acid. The applicator should be very thin and flexible, preferably of aluminum. For the preparation of the silver nitrate a few crystals of this substance should be melted in a little crucible (or in a little teacup if nothing else be available) by holding it over the flame of an alcohol lamp or Bunsen burner. The point of the applicator is now placed in the melted silver, when a delicate film will adhere to it. This should be allowed to cool, and by repeated dippings a bead of silver of any desired size may be obtained.

For the preparation of the chromic acid bead, the point of the applicator is heated to a red heat and placed in contact with a few minute crystals of the acid. These will instantly adhere. By passing the point a number of times through the flame the acid is more evenly distributed over the end of the applicator. The crystals should be held very near the flame, either on a piece of paper or in a crucible or watch glass, in order that the end of the applicator be not allowed to cool off when being transferred from the flame to the crystals.

The field surrounding the point of application of the caustic must be as dry as possible, otherwise the effect is too widespread.

Mastoid Disease

Probably the most important condition about the ear, at any rate from an operative standpoint, is that of purulent in-

flammation of the mastoid cells. This is due to extension of a suppurative process from the tympanic cavity and is often associated with a constitutional affection such as la grippe, scarlet fever, etc. While the symptoms are not always altogether characteristic there are a few which are important to appreciate.

Pain in the mastoid region is variable. It may be very insignificant and only amount to a sensation of painful fulness, or it may be so severe as to be unendurable, radiating down the neck or over the whole side of the head.

Anemia and prostration from loss of sleep and disturbed digestion are often present. These rather point to mastoid involvement.

Swelling or edema over the mastoid region is not always present. It is of course a positive symptom when the pus has ruptured through the bone and collected under the skin. The swelling may also be due to inflammation of the external canal. The mastoid cells may be filled with pus without even the slightest external manifestations of the affection.

Cessation or marked lessening in quantity of a chronic discharge from the ear, with pain, may be the first symptom of mastoid involvement. One is almost justified in making this diagnosis provided the cessation of discharge is accompanied by mastoid tenderness. This tenderness is elicited by pressure with the ball of the thumb over the tip of the mastoid process or over the position of the mastoid antrum. The pressure should be firm and prolonged for a few seconds. Pressure over the opposite mastoid process for comparison will also determine whether any discomfort is due to hypersensitiveness of the patient or to actual mastoid disease. This pain is not necessarily associated with discharge from the external canal, for mastoid disease may be present with an intact drum membrane.

The temperature is very variable, depending somewhat on the presence or absence of a constitutional disease. It may be as high as 103° to 105°, and may be accompanied by rigors. If the mastoid affection follows the subsidence of a general disease the temperature may be not much elevated, or it may remain entirely normal even in the presence of extensive destruction of

the parts. In infants and little children the temperature may be very high at first, and later fall to normal or even below.

The symptoms in children are not usually so well marked. Infants do not seem to suffer great pain during the establishment of the disease, although the temperature may be much elevated and the condition severe. Symptoms of exhaustion are usually present. Mastoid tenderness is uncertain, as the child squirms anyhow when it is touched whether it has pain or not.

Treatment.

The treatment of mastoid inflammations may be divided into two classes, viz., abortive and operative.

Abortive treatment consists in the following: The patient is preferably put to bed, and leeches are applied according to the method previously described. Following this, cold is used locally according to the method which is most convenient or feasible. Or if it be more agreeable to the patient the application of dry heat is also effective. Either of these should not be employed for a period longer than forty-eight hours, nor continuously for more than twelve hours. Important symptoms might otherwise be masked. If used during the day they should be discontinued during the night. If the symptoms are no worse in the interim they may be reapplied. A hypodermic injection of morphine may be given at the outset if the pain be unusually severe, but opiates are best avoided as much as possible. The application of iodine, plasters, poultices, and irritating ointments, is not desirable, as these only serve to make the patient more uncomfortable and render the skin in an unsuitable condition in case operation is later found necessary. Free drainage through the drum membrane is absolutely necessary, although this has as a rule already been established. A gauze wick is inserted into the canal as previously described, or syringing is resorted to, whichever seems most indicated. Salines are administered in sufficient quantity to produce free movement of the bowels, and light and easily digested food is given.

Operative.

In case there be no marked improvement at the end of forty-eight hours it will probably be necessary to operate.

The following applies not only to operations in acute cases, but in chronic cases as well.

A general anesthetic is required and therefore the ordinary preparation for this should be made.

The preparation of the field consists in shaving the head two and a half to three inches out from the mastoid region, or the whole side of the head if this be considered necessary. In the case of women the hair should be combed horizontally over the crown of the head and tightly braided on the opposite side. This manner of braiding the hair should be continued as long as is necessary following the operation in order not to interfere with the dressings. After having cleansed the external canal the field is scrubbed thoroughly with soap and warm water, using gauze or cotton as sponges. This is followed with ether and alcohol, or bichloride 1-5000. The external canal is rendered as thoroughly aseptic as possible according to the method previously described. Following this the field over the mastoid is again sterilized and a sterile gauze wick inserted deep into the canal. A dry aseptic pad is placed over all and is held in position by a sterile roller bandage. A compress of lint soaked in bichloride solution 1-5000 is preferred by some in place of the dry pad. This dressing remains in place until the patient is anesthetized, and after its removal the field is again sterilized in the manner as just described. A rubber cap, or moist towels, should be placed securely over the head, and the neck and chest should also be covered with moist sterile towels.

As to the instruments used and the operation itself, reference must be made to special books, as the subject is too extensive to permit of consideration in the limited pages of this work.

The simplest of all mastoid operations, that is, the so-called Wilde's incision might be mentioned, since this is merely an ordinary surgical procedure. It consists in a simple incision behind the auricle down to the bone, its purpose being to liberate the pus collected outside of the bone. The after-treatment is along general surgical lines.

The after-treatment of mastoid operations will probably be attended to by the surgeon himself or by the interne, and is

along general surgical lines. It may be considered under two headings, viz., acute and chronic cases. In the first the external wound is allowed to remain open, while in the chronic cases it is usually closed and dressings done through the external canal. In acute cases the cavity is packed with iodoform gauze or something similar, this being allowed to remain in situ for from five days to a week or longer, provided no symptoms develop such as pain, excessive discharge, rise in temperature, etc. When the gauze is finally taken out great care must be observed not to disturb the delicate granulations, and if necessary the gauze should be thoroughly soaked with an antiseptic solution before any attempt is made to remove it. Subsequent dressings are done at intervals not greater than forty-eight hours. The cavity when exposed is irrigated with an antiseptic solution such as bichloride 1-5000. When no further discharge is present the external wound is closed by the surgeon. Where suppuration still persists it may be necessary to keep the wound open for some length of time, and in order to accomplish this the gauze must be firmly packed to the bottom of the cavity so that healing may take place gradually from within outward. In this case it will also be necessary to attend to the secretion in the external canal. The treatment here is the same as previously described, that is, irrigation with antiseptic remedies, drying and plugging with absorbent cotton. The cotton plug may be changed by the patient as frequently as the amount of discharge demands. This treatment is continued until the parts are entirely free from discharge.

Another method of dressing acute mastoid cases is by dusting the walls of the cavity with a combination of boric acid 4, and iodine 1, and packing with iodoform gauze. A wood-wool pad with an aperture for the auricle is then applied. This absorbs all the post-operative exudate. If there are no symptoms such as mentioned above, the bandage remains undisturbed for a week. This is unsatisfactory if the secretive process does not cease early or entirely.

In the second class of cases, that is, the chronic ones, where the external wound is closed, the dressing is done through the external canal.

In the method adopted by some surgeons in chronic cases, that is, of packing the cavity with little balls of cotton dipped in iodoform, or some similar substance, these are removed at the first dressing through the external canal one by one, until the cavity is free from them. Others pack with iodoform gauze. This is changed at every dressing and replaced as often as the condition demands. After the cavity is free from any packing it is carefully cleansed every other day until healing has taken

Fig. 93. Roller Bandage—First Step.

place. This may be accomplished by gentle irrigation with an antiseptic solution or by the use of a cotton-tipped applicator, although in the early stages the latter is likely to disturb the delicate granulations. Where the posterior wall of the canal has been removed there is an astonishingly large cavity to treat, comprising as it does the tympanic cavity, the mastoid antrum and the mastoid cells. It is quite important that all parts and corners of this cavity be reached, for a cleansing of the main cavity would be of little avail if the more remote corners were neglected.

Roller Bandage.

In applying a roller bandage to the left ear, the free end of the bandage is held against the forehead with the thumb

of the left hand and a turn made completely around the head from left to right covering the starting point. On the second turn the bandage is made to pass down around under the occiput and back to the starting point, thus covering the left auricle. This latter turn is repeated once or twice, and then instead of passing around the head as before, the bandage is brought from the occiput up under the chin and around the head at right angles to the original turns. This last turn can

Fig. 94. Roller Bandage—Second Step.

also be repeated several times, and finally the turns in each direction are repeated alternately until sufficient protection has been attained. For bandaging the right ear the direction of application is of course the reverse.

After the external wound is closed no bandage need be applied. Plugging the external canal with cotton is quite sufficient.

Collodion Dressing.

A collodion dressing is often applied over the mastoid wound in the following manner: A piece of absorbent cotton is torn (not cut) from the sterilized roll, and flattened out so that it has a thickness of about one-fourth of an inch in the

fluffy state. It should be about one and one-half inches wide and sufficiently long to extend beyond the ends of the sutured wound. It is quite important that the cotton be *torn* from the roll and not cut off, as the ragged edges are quite necessary for the proper adherence of the dressing. The cotton is now laid over the sutured wound and the margins smeared with the collodion by means of a camel's-hair brush or a cotton-tipped applicator. It is also lightly smeared over the center of the cotton,

Fig. 95. Adhesive Plaster Dressing.

but in such a manner that only the superficial filaments are saturated. This is repeated several times, each time allowing the preceding application to dry, until a firm coating is formed with the cotton. In this way the irritating collodion does not reach the wound itself, and therefore does not become adherent to it. A great deal of discomfort and possible damage when removing the collodion dressing is also avoided. This is of course impracticable in the presence of much secretion.

Adhesive Plaster Dressing.

This may also be applied over the external wound when this remains open, but only when the discharge has almost ceased. The method is as follows: A piece of ordinary adhesive plaster is cut to such a size that the margins and ends of the wound

are overlapped for at least an inch. If necessary, little nicks may be made along the margin of the plaster in order to secure better apposition to the skin surface. The mastoid wound is first filled with sterile gauze, which should not protrude beyond the margins of the wound, and the plaster is applied directly over it. This is of course inadvisable in the presence of profuse discharge.

Shock and Pain.

As a rule there is but little shock following the operation. There may be some pain for twenty-four hours. This may be due to faulty dressing. If the pain persist for more than twenty-four hours there is probably something wrong and the wound should be inspected.

Sore Muscles.

There may be some soreness and stiffness of the muscles of the neck, particularly where the muscles have been separated from their attachment. This soon disappears.

Temperature.

Post-operative temperature seldom rises above 100 F. Marked post-operative temperature accompanied by increased pain usually indicates infection of the skin flap, stitch hole abscess, an undiscovered pocket, etc. These symptoms are usually relieved by a change of dressing, or evacuation of retained pus.

Bed.

The patient should remain in bed for a few days on restricted diet.

Change of Dressing.

The first change of dressing is generally made on the fifth or sixth day, provided there has been no pain or other untoward symptoms; that is, if the temperature has remained normal, the dressing dry and without odor. This first dressing is usually comparatively painless, as the gauze in the wound has become slippery and is therefore easily removed. If disturbed too early the filaments of gauze adhere and cause pain and bleeding on attempted removal. If the dressing becomes saturated with blood, or stiff and uncomfortable from dried secretion, it is best to change it earlier. It is seldom necessary to irrigate at the first dressing. The wound is gently wiped with

sterile cotton or gauze saturated with hydrogen peroxide or boric acid solution, and the dressing reapplied as at the time of the operation. Subsequent dressings are made at intervals of from twenty-four to forty-eight hours, depending upon the amount of secretion. If the secretion be profuse resort to irrigation, with boric acid or normal salt solution. Healing usually takes place in a month, although it is frequently much longer.

Other Considerations.

Rest and quiet from noise and excitement should be secured. The bowels should be opened on the third or fourth day, and tonics should be administered promptly if there has been much prostration.

Facial paralysis may follow operations on the mastoid. It may make its appearance immediately or may develop a day or two following the operation, beginning first by twitching of the facial muscles on the corresponding side. It is of variable degree, but is usually recognized by inability of the patient to smile, close the eyelids, or wrinkle the forehead on the operated side. This side of the face has a blank expression. The paralysis is often recovered from, but more often remains permanent.

The patient can usually leave the hospital in a week or ten days, but should remain indoors for still another week following this.

CHAPTER XII.

AIDS TO HEARING, HYGIENE, NOSE AND THROAT.

Aids to Hearing

There is an endless variety of instruments used for the purpose of improving hearing. The most practical instrument of all, however, is the long rubber hearing tube with a funnel-

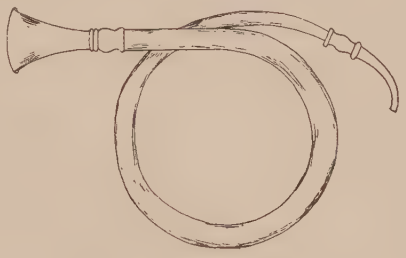

Fig. 96. Hearing Tube.

shaped extremity into which the speaker talks. Whatever the form of the tube is, the principle is always the same, namely the collection of the sound waves.

Artificial ear-drums are usually of very little benefit, and their presence in the canal as a foreign body frequently outweighs any benefit derived from their use. The so-called Toyn-

Fig. 97. Toynbee Ear Drum.

bee's ear-drum is perhaps the most frequently employed. This consists of a little india rubber disc one-third of an inch in diameter and very thin. Attached to it is a delicate silver wire one and one-quarter inches long, bent at its free end in the form of a little loop. Before its introduction it is moistened with glycerine, warm water, or some antiseptic solution. The disc is inserted into the canal until it presses against the remains of the

drum membrane or against the exposed ossicles. At first it is worn for only an hour or two a day, but the interval can gradually be lessened until it is allowed to remain in for the entire day. It should always be removed and cleansed at night. Such artificial drums should not be used in children, nor in the presence of discharge from the ear.

An ordinary cotton plug about the size of a pea when moistened is equally as effective as the rubber disc. This is the so-called artificial ear drum of Yearsley. A little string is attached to it to facilitate its removal. After being moistened

Fig. 98. Yearsley Ear Drum.

with water or liquid vaseline it is introduced deep into the canal until it rests against the remains of the drum membrane, or in such a position as to give the best results. This can best be determined by the patient himself from its influence upon the hearing. There is a special forceps for this purpose, although the ordinary ear pincette answers the purpose very well. This plug should also be removed at night.

The patient should be instructed in the introduction of these artificial drums according to the method described when considering the subject of drying the ear; that is, with the opposite hand over the head, and the auricle pulled upward and backward.

Various unpleasant symptoms may be excited upon introduction of the artificial drum, such as for instance, ringing, itchiness, sensation of foreign body, etc., all of which are frequently relieved by changing the position of the drum, or are disregarded after a few days.

In certain cases the hearing may be markedly improved by the Yearsley artificial drum, the effect being noticed immediately. If no improvement be experienced after several trials it is best to discontinue its use.

Hygiene

There are various rules of hygiene with which every one should be familiar, and an enumeration of a few of them will not be out of place in a work of this character. If the hearing

should become impaired, the aid of a competent aurist should be sought at once. Any tendency of the individual to "catarrh" or "taking cold" should be combatted by cold sponging of the neck and chest every morning, this to be followed by a brisk rubbing with a coarse towel. Such treatment cannot always be borne well by those of delicate constitution, and in such cases it should not be resorted to. It is also contraindicated where middle-ear disease exists. The feet should be protected in wet weather, and unnecessary exposure avoided as much as possible. The temperature of the living room should not be higher than 72° F., and the windows of the sleeping room should be open sufficiently to admit air freely during the night.

The wearing of cotton in the ear when no discharge is present should not be resorted to unless by order of the aurist.

When one is suffering from a suppurative condition in his own ear, great care should be exercised in handling surgical cases, as infection may be carried to the wound.

In case of exanthematous diseases particular attention should be paid to the development of ear symptoms. In measles involvement of the ear may take place at any time in the course of the disease, whether in the beginning or in the desquamative stage. Middle ear disease following scarlet fever is very common and is usually due to extension of the inflammation from the naso-pharynx.

Instruments of any kind should not be used in manipulations within the external canal unless one knows just how to use them and has proper illumination.

In inflammatory conditions in the ear a protective dressing should be applied to the affected side at night. In case the patient has been lying on the affected side, which becomes warm in consequence, exposing it to the influence of the cooler atmosphere of the room upon changing his position might have a deleterious influence upon the condition.

Avoid the following: Anything tending to increase a catarrhal condition of the nose and throat, including unhygienic surroundings. Drugs in excess, such as quinine and salicylates. Direct exposure to cold wind. Promiscuous use of drops, particularly oils, because of their irritating effect when

they become rancid; they also favor the development of fungi in the canal. Syringing the ear with cold water. Scratching the ear with hair-pins, tooth-picks, matches, or special instruments devised for the purpose. Vegetable poultices and animal grease, or too prolonged use of any sort of poultice or application. Too prolonged application of heat or cold. Trickling of ice water into the ear when making cold applications. Seabathing, diving and "ducking" when a perforation of the drum membrane is known to exist. Blowing the nose immediately after spraying or irrigating the nasal cavities. The nasal douche. Valsalva's method of inflating the ears. Loud noises. Boxing the ears.

By the observance of some of the above points much discomfort and possible serious impairment of hearing could be avoided.

Nose and Throat

About 90 per cent of all ear affections are due to some primary affection in the nose or throat. This is notably true of chronic conditions. Adenoids are particularly prone to produce ear affections in that they exert pressure on the mouths of the Eustachian tubes and favor the development of a catarrhal condition of the mucous membrane. Acute rhinitis is also often responsible for conditions in the middle ear, particularly in case of exanthematous diseases. Cauterization of the nose is frequently followed by acute otitis media. Purulent affections of the neighboring sinuses of the nose often produce suppurative otitis media and mastoiditis by direct extension through the Eustachian tubes. Snuffing up of solutions into the nose is a pernicious and dangerous practice, unless properly done, and very frequently results in affections of the ear as a result of the propulsion of the solution or of secretions through the Eustachian tube into the tympanic cavity. It also often produces headache and aggravates an acute rhinitis. An ordinary spraying apparatus, or irrigating bulb such as was described when speaking of irrigation of the eye, is perhaps the best and most satisfactory means of applying solutions to the interior of the nose. The solution should of course be warm and should be introduced through the side which has the most ob-

struction. One nostril should always be left open in order that the solution may escape. The post-nasal space is closed off from the pharynx by the voluntary contraction of the palate muscles from the stimulation of the stream. The patient should be requested to hold his breath while the irrigation is being done. The stream is projected directly backward. Too much force must not be used, and it is well to frequently interrupt the stream. Blowing the nose vigorously should be avoided for at least fifteen minutes following the irrigation. In blowing the nose under any circumstances one nostril should always be left open. Never blow the nose with both nostrils occluded on account of the danger of forcing secretions up into the middle ear. If fulness in the ears follow the irrigation, this can usually be relieved by swallowing several times. Normal salt solution is probably the most effectual for dissolving the secretions, although any of the alkaline solutions, such as Seiller's solution, Dobell's solution, etc., can be employed.

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